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ABSTRACT

This newsletter contains six articles: (1) "Early Flavor Experiences: When Do They Start?" Julie A. Mennella and Gary K. Beauchamp); (2) "Infant Massage" (Tiffany Field); (3) "The Infant's Sixth Sense: Awareness and Regulation of Bodily Processes" (Stephen W. Porges); (4) "Sensory Contributions to Action: A Sensory Integrative Approach" (Marie E. Anzalone); (5) "Sensory Experiences in Infancy" (Lois Barclay Murphy with Rachel Moon); and (6) "An Earlier Head Start: Planning an Intervention Program for Economically Disadvantaged Families and Children Ages Zero to Three" (Edward Zigler and Sally J. Styfco). The newsletter also contains notes from the retiring director of Zero To Three; a letter to the editor; and descriptions of several videotapes and publications on topics related to child development. (BC)

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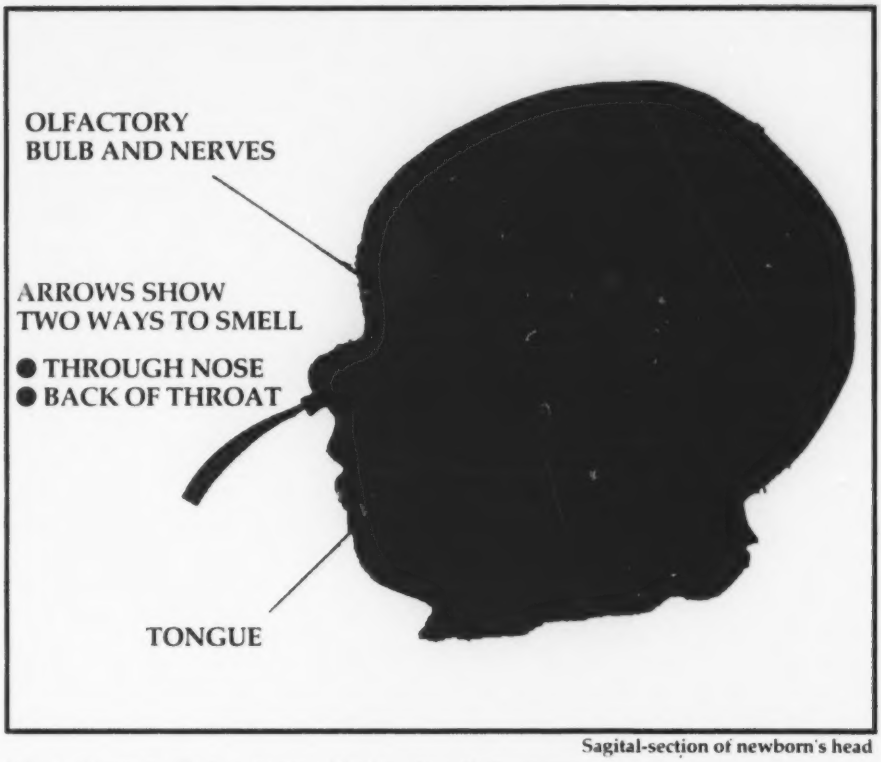
Early Flavor Experiences: When Do They Start?



Sagital-section of newborn's head

Julie A. Mennella, Ph.D., Assistant Member, Gary K. Beauchamp, Ph.D., Member and Director, Monell Chemical Senses Center, Philadelphia, PA

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Anyone who has observed infants for any period of time can testify to the intense activity occuring in and around their mouths—a primary site for learning in the first few months of life. During feeding, or while mouthing objects such as their hands and toys, infants learn to discriminate the varying features of their new world. They use the sense of touch to discriminate between textures, and the senses of taste and smell to discriminate flavors. Before they are even able to crawl, infants have learned much about their sensory world.

Knowledge of flavor perception in the human infant has expanded substantially over the past few decades. It is now widely recognized that newborn infants are not passive receptacles for flavors—rather they avidly accept some, while decidedly rejecting others.

Through human and other animal studies, we have also learned that the flavor aspects of foods eaten by mothers are transmitted through their milk to their infants, with the odor of garlic being a good example.[1,2] These studies suggest that mother's milk is a potentially rich source of flavor experiences, affording breast-fed infants an early opportunity to learn about the "flavor" of their culture. That is, American, African, East Indian, Asian, Middle Eastern, European and Hispanic children alike, may all become familiarized with the spicing and seasoning of their mother's diet, long before solid foods are ever introduced.

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That these early flavor experiences affect later food acceptability is suggested by other animal studies. The research shows that young animals prefer the flavor of the foods eaten by their mothers during nursing[3,4,5,6,7] and that their young are also more likely to accept unfamiliar foods if they have experienced a variety of flavors during suckling.[8]

In contrast to the potentially variant chemosensory experiences of breast-fed infants, bottle-fed infants experience a constant set of flavors from standard infant formulas. Though receiving appropriate nutrition, bottle-fed infants may be missing significant sensory experiences which, until recent times in human history, were common to all infants.

In this article we will discuss how amniotic fluid and human milk are potentially rich media for early flavor experiences. We will also discuss how the chemical senses of taste and smell change during infancy. First, however, we must establish a basic understanding of taste and smell and the differences between them.

What is flavor?

The "flavor" we experience while eating foods is a product of two frequently confused chemical senses: taste or *gustation* and smell or *olfaction*.

Taste refers to the sensation occurring when chemicals stimulate taste receptors on the tongue and other parts of the oropharynx. Taste stimuli are often separated into a small number of "primary" tastes: sweet, salty, bitter, sour, and perhaps savory, the taste of "umami" or monosodium glutamate.

Smell, on the other hand, occurs when chemicals stimulate olfactory receptors in the nasal cavity. Unlike the sense of taste, there may be many different classes of odor stimuli, perhaps thousands. Odors can reach the olfactory receptors in two ways: they can enter the nostril during inhalation (orthonasal route) or they can travel from the back of the nasopharynx toward the roof to the nasal cavity (retronasal route) during suckling in infants or chewing and swallowing in older children and adults.

Retronasal olfaction contributes significantly to the perception of flavor. For example, holding one's nose while eating interrupts retronasal olfaction and eliminates many of the subtleties of food, leaving only the taste components (sweet, salty, sour, bitter and savory) remaining. The importance of smell in flavor perception is most clearly noted by head cold sufferers who lose the ability to discriminate common foods when olfactory receptors are blocked. Similarly, foods often taste better after a person quits smoking because their sense of smell has improved[9] allowing them to detect more subtleties of flavor. The role of smell in flavor is critical to enjoying foods like licorice, vanilla and citrus, which can only be experienced through the sense of smell.

It should be noted that other properties of food (e.g., viscosity, temperature, irritation) are also very important to its perceived flavor. However, little experimental work

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Table 1. *Developmental Changes in the Infant's Response to Tastes.*[a]

		Fetus and Premature Infants	Newborns	Older Infants (1-24 months)
Sweets:	Sugars	Preference	Preference	Preference
Sour:	Citric Acid	Not Known	Rejection	Rejection
Bitter:	Quinine	Not Known	Rejection	Not Known
	Urea	Not Known	Indifference Rejection[b]	Rejection
Salty:	NaCl	Not Known	Indifference Rejection[c]	Indifference Preference[e]
Savory:	MSG	Not Known	Preference[d]	Preference[d]

a Infants' responses to various tastes solutions relative to water or diluent.

b Facial expressions suggest rejection, whereas intake studies suggest indifference.

c Sucking measures suggest rejection, whereas intake and facial expression studies suggest indifference.

d Preference seen only when MSG mixed with soup; MSG solution alone is rejected relative to plain water.

e Preference emerges at approximately four months of age; prior to that, indifference or rejection depending on the methods used.

has been done in this area of infant flavor perception. Therefore, in this article, we will focus on the infant's senses of taste and smell.

Developing sensitivities and preferences

The sensory world of the young infant differs from that of the adult in that the infant's sense of taste develops over time (Table 1). Specifically, sweet responses are evident prenatally, and major changes are not known to occur postnatally. Similarly, the rejection of sour taste is evidenced from birth onwards, while salt and bitter sensitivities appear to change postnatally.

Less is known about how olfactory perceptions and preferences change over time. Clearly infants are able to detect and discriminate among a wide variety of odors shortly after birth. But it is not yet known whether they hedonically respond to differences in odor quality, viz., which odors infants find pleasant.

Fetus and premature infants

Studies on taste. Taste cells first appear in the human fetus at seven to eight weeks gestation, with morphologically mature cells appearing at about 14 weeks.[10] These receptors may be stimulated by the varying chemicals presented in the amniotic fluid when the fetus begins to swallow episodically at about the twelfth week gestation.[11,12]

Studies on taste sensation in the preterm infant are rare, due in part, to methodological limitations. When preterm infants, who had been fed exclusively via gastric tubes, were presented with minute amounts of either glucose or water solutions intraorally, they exhibited more non-nutritive sucking in response to the glucose than the water.[13]

Because immature suck-swallow coordination puts premature infants at risk for aspirating fluids, researchers at Monell have developed a new methodology that embeds taste substances in a nipple-shaped gelatin medium.[14] Small amounts of a substance are then released when the nipple is mouthed or sucked, eliminating the need for administering fluids during testing. Infants born pre-term and tested between 33 and 40 weeks post conception produced more frequent, stronger sucking responses when offered a sucrose-sweetened nipple compared with a latex nipple.

Editor's Note:

Life is a sensory experience, the contributors to this issue of *ZERO TO THREE* remind us. Healthy babies come into this world beautifully equipped to get acquainted with it and to discover how to use it to meet their needs. Adults have a great deal to do with shaping the sensory experiences of infants and very young children: our cultural traditions, our own childhood experiences, and our emerging understanding of developmental processes all contribute to the sensory experiences that we offer babies through caregiving routines, opportunities for play and exploration, and responses to individual preferences and needs for comfort.

Coming from a range of research disciplines and traditions, the contributors to this issue share their discoveries about the ways in which infants use their sensory systems to detect, discriminate, and adapt to the world. They enable us, in turn, to be wiser and more attentive responders to babies' sensory preferences, gifts, and sensitivities.

The results from these studies indicate that, prior to birth, the human infant possesses a sensory apparatus that can detect sweet tastes.

Studies on smell. While the olfactory system is well developed prior to birth,[15] it is not known whether the fetus responds to olfactory stimuli. However, recent reports indicate that the environment in which the fetus lives—the amniotic fluid—can indeed be odorous. This odor can indicate certain disease states (such as maple syrup disease,[16] phenylketonuria[17] and trimethylaminuria[18]) or the types of foods eaten by the pregnant mother.[19] That the amniotic fluid and the newborn's body can acquire the odor of a spicy meal the mother ingested prior to giving birth suggests that odorous compounds in her diet can be transferred to the amniotic fluid. Because the normal fetus swallows significant amounts of amniotic fluid during the latter stages of gestation[20] and has open airway passages that are bathed in amniotic fluid,[21] the fetus may be exposed to a unique olfactory environment. Studies on other animals reveal that adults prefer certain odors that were experienced *in utero*.[22] Whether similar mechanisms are operating in humans remains unknown.

Newborns

Studies on taste. Facial expressions, which suggest contentment and liking or discomfort and rejection, have been used to assess the newborn's responsiveness to taste stimuli in some of the earliest investigations on human taste development. During the first few hours of life, infants display relatively consistent, quality-specific facial expressions when the sweet tastes of sucrose (facial relaxation, followed by positive mouth gaping), the sour taste of concentrated citric acid (lip pursing and facial grimace) and the bitter taste of concentrated quinine and urea (tongue protrusion and grimace) are presented into the oral cavity.[23,24,25] No distinct facial response is evidenced with salt taste, however. Infants also display distinct positive facial expressions, similar to those observed with sweetness, when tasting soup to which monosodium glutamate (MSG) has been added when compared to the soup diluent alone.[26] MSG alone does not appear to elicit those facial responses, however, raising the question of exactly what it is about the MSG-flavored soup that is of apparent positive hedonic value.

Intake studies, which compare how much an infant consumes of a taste solution and a diluent solution during brief presentations, are the most frequent method used to evaluate taste preferences. Generally, intake studies use weaker concentrations of taste stimuli than studies on facial expressions. If an infant ingests more of the taste solution than a diluent, for example, one can infer that a) the infant can detect the taste and, with less certainty, b) the infant prefers or likes the tastant more than the diluent.

Consistent with the findings for premature infants, these studies repeatedly demonstrate strong acceptance of sweet-tasting sugars by newborn infants. Newborns will respond to even dilute sweet solutions and they can differentiate varying degrees of sweetness and different kinds of sugars.[27] In contrast, they reject the sour taste of citric acid, and are apparently indifferent to the taste of low to moderate concentrations of salt and the bitter taste of urea.[28]

Finally, as was the case for premature infants, newborns' sucking patterns have been used in taste research as an alternative to intake studies. These studies also indicate that sweet stimuli are positive and salt taste is negative, in that salt intake suppresses sucking relative to the infant's response to the diluent alone.[29]

Although each measure has its limitations, the convergence of research findings supports the conclusion that the ability to detect sweets is evident very early in human development and that its hedonic tone—that is, its pleasantness—is also well developed at birth. It is likely that the innate liking of sweets and rejection of bitter tastes in humans is a consequence of selection, favoring animals who consumed high-energy, vitamin-rich fruit and vegetables diets, while avoiding bitter, poisonous fruits and plants. Although the preference for sweet tastes appears to be innate, experience with them may also play an interacting role in development. There is, however, no evidence in humans that variations in early exposure to sweets permanently alters the preference for sweet tasting foods.[30] Fewer studies on sour tastes have been conducted with newborn infants, but those that have been done suggest that sour-tasting substances are unpleasant. Because of the lack of research, it is not known whether there are developmental changes in sensitivity of preference for sour-tasting compounds.

Conclusions regarding the neonate's response to bitter and salty tastes are more problematic. Newborns respond with highly negative facial expressions to concentrated quinine and urea but they do not reject moderate concentrations of urea.[25] The reason for this difference remains unclear. Perhaps the newborn can detect bitter substances, but the ability to reject a substance or modulate intake will come as the infant matures. Further studies using a variety of bitter stimuli and additional behavioral measures could resolve this question. With regard to salt perception, studies measuring intake and facial expressions suggest that the newborn infant is indifferent to and may not detect salt. However, salt does appear to suppress some parameters of sucking in newborns. Here too more research is needed to clarify the newborn's response to salt. No studies suggest, however, that the taste of salt is attractive to the newborn infant.

Studies on smell. Odor preferences in newborns are more difficult to assess. However, we do know that, shortly after birth, human infants are able to detect a wide variety of odors, with perhaps the most salient of these odors originating from the mother. Within hours after birth, mothers and infants can recognize each other through the sense of smell alone. Day-old breast-fed infants spend more time orienting toward a breast previously worn by their lactating mothers than one worn by

Sequence of facial expressions elicited from 3-day-old infant

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an unfamiliar lactating woman.[31,32,33] They move their head and arms less and suck more when they are exposed to their mother's odors.[34] This ability of breast-fed infants to discriminate the odors of their mothers from those of other lactating women is not limited to odors emanating from the breast region. They can also discriminate odors originating from their mother's underarms and neck.

Interestingly, bottle-fed infants do not discriminate their mothers' odors from those of an unfamiliar bottle-feeding mother.[33,34] It has been suggested that breast-fed infants are able to discriminate these odors because they, unlike bottle-fed infants, have prolonged periods of skin contact with their mothers and their nostrils are in close proximity to their mother's breasts and underarms during feeding. Recent studies, however, suggest that bottle-fed infants also prefer the breast odors of lactating women.[35] Therefore, breast odors, or the volatile components of breast milk, may be particularly attractive to all newborns.

Older infants

Studies on taste. Babies beyond the neonatal period (one to 24 months) have been most neglected in studies on taste development. Nonetheless, a few notable findings suggest that changes in taste responses occur during this time in development.

Studies conducted in Mexico focused on the responses of well-nourished and malnourished infants, aged two to 24 months, to determine whether the protein-calorie status of the infants affected their taste preferences.[36] At all ages, both the well-nourished and the malnourished infants preferred the sucrose but rejected the bitter (urea) and sour (citric acid) stimuli. The infants under the age of one year preferred the salty solutions, whereas those older than one year were indifferent to the salt.

While newborn infants are indifferent to or reject salt relative to plain water, a developmental shift in salt acceptability has been supported in more recent studies of children from the United States, where preferential ingestion of salt water relative to plain water first emerged at approximately four months of age.[37] It has been argued that experience with salty tastes probably does not play a major role in the shift from indifference or rejection of salt at birth to acceptance in later infancy.[37] Rather this change in response may reflect postnatal maturation of central and/or peripheral mechanisms underlying salt taste perception. Thus the salt preference that emerges at approximately four months of age may be largely unlearned. Although animal model studies demonstrate that early alterations in sodium balance alters long-term salt preference behavior,[38] whether this occurs in humans is unknown.

A recent study on the infant's sensitivity to bitter taste revealed that relatively low concentrations of urea were not rejected in newborn infants, but rejection was evident among infants who were 14 to 180 days of age.[39] This is consistent with the idea that there is an early developmental change in bitter perception or the ability to regulate the intake of bitter solutions. As a practical matter, it could explain why older infants reject bitter tasting foods, like green vegetables. Parents can expect a "learning period" when introducing these foods, and anticipate a need to introduce them slowly, but consistently. With exposure, eventually these foods may be tolerated and even enjoyed.

Studies on smell. During the past few years, research at Monell has focused on the early olfactory experiences of the human infant, using mother's milk as the medium for these experiences. As mentioned earlier, we have demonstrated that human milk, like the milk of other animals,[2] can acquire a wide variety of odors from the mother's diet. The breastfeeding infant's ability to detect the sensory changes in the mother's milk is suggested by the infant's altered suckling behavior when the milk is flavored, e.g., the infant feeds longer and sucks more overall when the milk is flavored with garlic.[1] The mouth movements made during suckling may facilitate the retronasal perception of the garlic volatiles in the milk, enhancing the infant's ability to "taste" the change.

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The flavor of human milk is also altered when nursing women drink alcohol, a beverage that has been recommended for centuries to nursing mothers as an aid to lactation. Folklore relates that drinking small quantities of alcohol shortly before nursing increases milk yield, facilitates milk let-down, and relaxes both the mother and her baby. In recent studies, alcohol consumption by nursing mothers was shown to alter the flavor of the mothers' milk and the behavior of their infants during breast feeding.[40,41] Unlike the response to garlic-flavored milk, the infants did not feed longer when the milk was flavored with alcohol. They did however, consume significantly less alcohol-flavored milk—even though they sucked more during the initial minute of the feedings. Whether the infants were responding the altered milk flavor or whether the alcohol was having a pharmacological effect on the nursing mothers is the subject of present investigations. Whatever the case, it would seem that the recommendation for a nursing mother to drink a glass of beer or wine before nursing may actually be counterproductive. While the mother may be more relaxed after a drink, her baby will ingest less milk.

Conclusion

The flavor world of the breast-fed infant is potentially much richer than previously thought. Because research shows that the senses of taste and smell are not only functioning in the human neonate, but also change during development, breast-fed infants may be afforded an opportunity to learn about the flavor of the foods of their people long before solids are introduced.

Based on a variety of animal model studies,[3,8] an infant's prior exposure to flavors in mother's milk may actually increase the desirability of those flavors through familiarization. Unfamiliar foods, which are often not preferred by children, become preferred with repeated presentations and increased familiarity;[42] bitter tastes, such as green vegetables, are a notable example. Studies on other animals[3] also suggest that the experience with a variety of flavors during breastfeeding, in contrast to the invariant flavor experience during formula feeding, predisposes breast-fed infants towards an increased willingness to accept unfamiliar flavors. Indeed, a recent study revealed that breast-fed infants will consume more of a novel vegetable than will their formula-fed counterparts.[43]

Finally, recent studies indicate that 25 percent of bottle-fed infants experience a change in formula during the first months of life, usually in response to non-specific symptoms.[44] Perhaps, as Da Mota[45] has suggested, "this monotony, which is contrary to the most basic rule in dietary habits, might just prove too much for one in four babies."

As a relatively new and exciting area of study, many questions remain unanswered about the infant's sense of taste and smell. The long-terms goals of research at Monell are to uncover whether exposure to flavors in the amniotic fluid or mother's milk affects the infant's later preferences, the development of food habits, and the infant's willingness to accept new foods at weaning or thereafter. Also worthy of study is how early feeding style (breast or bottle feeding) affects later behavior. This is especially relevant when considering amniotic fluid as a potential "flavor bridge" to breast milk, and then breast milk, as a bridge to solid foods.

Although much research is still needed to fully understand how the infant is affected by experiencing flavors in mother's milk, it is clear that human infants are not passive receptacles for flavored foods. Rather, they will avidly accept some flavors, while decidedly rejecting others. Because every baby is an individual, with his or her own likes and dislikes, parents should expect that their child will need time to learn to like some foods, while never liking others.

Parents who offer their babies and growing children a variety of foods will provide both a nutritious, well-balanced diet as well as an opportunity for their child's own personal tastes to develop.

The Monell Chemical Senses Center, founded in 1968, is the only nonprofit scientific institute dedicated to research on the mechanisms and functions of taste and smell.

Monell's scientists have expertise in many fields, and this diversity of backgrounds is reflected in their varied research interests. Using a multidisciplinary approach to study the chemical senses, Monell's research spans the areas of neuroscience, perception, nutrition, clinical medicine, chemical ecology, and chemistry.

Research at the Center is collaborative, and usually involves scientists from several disciplines. In addition to in-house collaboration, researchers at Monell work with colleagues from major scientific and educational institutions and industrial corporations throughout the world.

The results of Monell's research are used in a range of endeavors, including disease diagnosis, expansion of the world's food supply, optimizing growth and development in animals and humans, gaining better understanding of reproductive physiology, and improving the quality of life.

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Infant Massage

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The Calcutta mother lays her infant on his stomach on the mother's outstretched legs, and the body parts are individually stretched. Warm water and soap are applied to the lower extremities for massage, followed by the arms, back, abdomen, neck and face. The massage looks extremely rigorous (almost rough), so it is not surprising that the infant (following swaddling) then sleeps for prolonged periods. The Indian infant massage is a daily routine that begins in the first days of life. Some have related the precocious motor development of these infants to their daily massage. Infant massage therapists are not surprised, as they maintain that the massage provides both stimulation and relaxation. It stimulates respiration, circulation, digestion and elimination. They claim that infants who are massaged sleep more soundly and that the massage relieves gas and colic and helps the healing process during illness by easing congestion and pain.

Infant massage is a common child care practice in many parts of the world, most especially Africa and Asia. For example, infants are massaged for several months of their life in Nigeria, Uganda, India, Bali, Fiji, New Guinea, New Zealand (among the Maori), Venezuela and the Soviet Union (Auckett, 1981). In most of these countries the infant is given a massage with oil following the daily bath and prior to sleep time.

Infant massage in the Western world

In Eurocentric cultures, infant massage is only recently being discovered and researched. In the United States, for example, massage therapy schools are beginning to teach infant massage, infant massage therapists have founded a national organization of approximately 4,000 therapists, and those therapists in turn are setting up institutes to teach parents infant massage. The techniques they use are based primarily on the teachings of two massage therapists who trained in India (Amelia Auckett who published a book on infant massage in 1981 and Vimala Schneider McClure who published a similar book on infant massage in 1989).

Although these infant massage training groups are located now in most parts of the United States, very little research has been conducted on the use of infant massage with healthy infants. Working with healthy infants, infant massage training groups report that massage:

1. Facilitates the parent-infant bonding process in the development of warm, positive relationships;
2. Reduces stress responses to painful procedures such as inoculations;
3. Reduces pain associated with teething and constipation;
4. Reduces colic;
5. Helps induce sleep; and
6. Makes parents "feel good" while they are massaging their infants.

They report that infants who are blind and/or deaf become more aware of their bodies, and that infants born prematurely and infants with cerebral palsy also benefit by more organized motor activity.

In the following sections, we present research findings on massage therapy with preterm infants, neonates exposed to cocaine and HIV, and infants who have been abused or neglected. Data are also presented on the positive effects of giving massages for the person who gives the massage and on the infant-adult relationship.

Massage therapy with preterm infants

Most of the data on the positive effects of infant massage come from studies on preterm infants. During the last two decades, a number of investigators have researched the effects of massage therapy (earlier called tactile/kinesthetic stimulation) on the preterm newborn (Barnard & Bee, 1983; Rausch, 1981; Rice, 1975; Solkoff & Matuszuk, 1975; White & LaBarba, 1976). Generally the results published by these investigators have been positive. In a recent meta-analysis of 19 of these stimulation studies Ottenbacher et al. (Ottenbacher, Mueller, Brandt, Heintzelman, Hojem & Sharp, 1987) estimated that 72 percent of infants who received some form of tactile stimulation were positively affected. Most of these investigators reported greater weight gain and better performance on developmental tasks for the preterm infants receiving massage therapy.

Interestingly, those who did not report significant weight gain among massaged infants used a light stroking procedure, which we have since found is aversive to babies, probably because it is experienced as a tickle stimulus. Those infants who showed weight gain were provided more pressure, probably stimulating both tactile and pressure receptors.

One of the studies used in this meta-analysis was conducted in our lab starting in 1984. In that study we provided 40 preterm neonates 45 minutes of massage per day (in doses of 3 fifteen minute periods) for 10 days (Field, Schanberg, Scafidi, Bower, Vega-Lahr, Garcia, Nystrom & Kuhn, 1986). The infants averaged 31 weeks gestational age, 1280 grams birth weight and 20 days in intensive care prior to the time of the study. They were recruited for the study when they had graduated from the "Grower Nursery," at a time when their primary agenda was to gain weight.

The massage sessions were comprised of 3 five-minute phases. During the first and third phases, tactile stimulation was given. The newborn was placed in a prone position and given moderate pressure stroking of the head and face region, neck and shoulders, back, legs and arms

for five one-minute segments. The Swedish-like massage was given because, as already noted, infants preferred some degree of pressure, probably because the light stroking was experienced as a tickle stimulus. The middle phase (kinesthetic phase) involved flexing of the infants' limbs (moving them into flexion and then extension much like bicycling motions) while the infant was lying on his back.

The results of this study (published in Pediatrics in 1986) suggested that:

- The massaged infants gained 47 percent more weight, even though the groups did not differ in calorie intake;
- The massaged infants were awake and active a greater percentage of the observation time (much to our surprise, since we had expected that the massage would stimulate a soporific state and greater sleep time, leading to weight gain via lesser energy expenditure and calories);
- The massaged infants showed better performance on the Brazelton Scale on habituation, orientation, motor activity and regulation of state behavior;
- The massaged infants were hospitalized, on average, six fewer days than the control infants, yielding a savings in hospital costs of approximately $3,000 per infant.

Robin Gregory

Massaging preterm infants prenatally exposed to cocaine

In the interim, a relative newcomer to the NICU, the cocaine-exposed preterm infant, provided us with another sample of infants who could presumably be helped by massage therapy. We conducted a study in which the same type of massage was administered three times daily for a 10-day period, with the hope that much the same effects would occur. The data suggested the following:

- The massaged cocaine-exposed preterm infants had fewer postnatal complications and exhibited fewer stress behaviors during the 10-day period;
- They had a 28 percent greater daily weight gain; and
- They demonstrated more mature motor behavior on the Brazelton Neonatal Behavioral Assessment at the end of the 10-day period (Wheeden, Scafidi, Field, Ironson & Valdeon, in press).

Massaging neonates exposed to HIV

Still more recent newcomers to the NICU are infants who have been exposed to HIV. Dr. Scafidi and our colleagues are currently investigating whether massage therapy also improves immune functioning in HIV-exposed newborns and whether massage therapy given by parents can improve the mental, motor, and social development of the infants, as well as give the mothers a sense of worth and reduce guilt feelings for having transmitted this disease to their infants. We have noted very impressive participation on the part of the mothers with HIV — almost 100 participation in administering three massages per day to their infants for the first two weeks of life. The data suggest the following:

- Greater weight gain for the massaged infants;
- Better performance by the infants on the orientation and motor clusters of the Brazelton scale; and
- Better performance on a stress behavior scale including alert responsiveness, cost of attention, examiner persistence, state regulation, motor tone and excitability.

Looking for underlying mechanisms

Our collaborator Saul Schanberg has been conducting studies with Cynthia Kuhn at Duke University in which rat pups are removed from their mother to investigate touch deprivation and attempts are made to simulate the mother's behavior to restore physiology and biochemistry of the rat pups to normal. In several studies Schanberg and Kuhn noted a decrease in a growth hormone among rats deprived of touch (Schanberg & Field, 1988). This decrease was noted in all body organs including heart, liver and brain and in all parts of the brain including cerebrum, cerebellum and brain stem. These values returned to normal once the pups were stimulated.

A graduate student/animal caretaker observed rat mothers' nocturnal behavior and noted that they frequently tongue lick, pinch and carry around the rat pups. When they tried each of these maneuvers with the rat pups, only the tongue licking (simulated by dipping a paint brush in water and briskly stroking it all over the body of the rat pup) restored these values to their normal level. More recently, Schanberg and his colleagues discovered a growth gene that responds to tactile stimulation, suggesting genetic origins of this touch/growth relationship.

Realizing that an exploration of under-the-skin vari-

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ables, including physiology and biochemistry, might suggest an underlying mechanism in the human model, we added physiological and biochemical measures to our next study. This study with preterm infants basically confirmed our previous data set. In this sample, the stimulated infants showed a 21 percent greater daily weight gain, they were discharged from the hospital five days earlier, they showed superior performance on the Brazelton Habituation items, and they showed fewer stress behaviors (mouthing, grimacing, and clenched fists) (Scafidi, Field, Schanberg, Bauer, Tucci, Roberts, Morrow & Kuhn, 1990).

In addition, we noted that these infants' catecholamines (norepinephrine, epinephrine) had increased across the stimulation period (Kuhn, Schanberg, Field, Symanski, Zimmerman, Scafidi & Roberts, 1991). (Although these catecholamines typically increase following stress in the adult, suggesting that an increase is undesirable, an increase during the neonatal period would be considered desirable since there is a normal developmental increase following birth.) Thus, the massage therapy apparently facilitated the normal developmental increase in these catecholamines in the stimulated preterm infants. We also discovered that their vagal activity increased during massage therapy sessions.

This observation, plus the work of Uvnas-Moberg in Sweden, led us to some ideas about underlying mechanisms. Uvnas-Moberg and her colleagues have reported that stimulating the inside of the mouth of the newborn (and the breast of the mother) led to the increased release of gastrointestinal food absorption hormones such as gastrin and insulin (Uvnas-Moberg, Widstrom, Marchine & Windberg, 1987). It is conceivable that another form of tactile stimulation, such as the massage therapy, on different body parts would also lead to the release of gastrointestinal food absorption hormones, probably stimulated by vagal activity. Thus, we are currently assaying glucose and insulin levels in the heelstick samples of preterm infants. Our preliminary data suggest that the massaged infants are showing elevated levels of both glucose and insulin.

Depressed mothers massaging their infants

Because we need a cost effective way to deliver massage therapy to infants, and because parents as massage therapists may benefit themselves from giving massage, and because the massage experience may improve the parent-infant relationship, in our studies we are increasingly teaching parents to administer massage therapy. In a study currently underway, we are teaching mothers who are depressed to massage their infants. We want to examine the effects of the massage therapy on the infants' disorganized interaction behavior and their disturbed sleep patterns.

Adolescent mothers who have high Beck Depression Inventory scores are recruited for the study shortly after their infants are born. For this study we have asked the depressed mothers to perform a 15-minute massage daily for a two-week period. Preliminary results suggest the following:

Christopher Wright

- Infants' drowsiness and quiet sleep increased immediately following the massage, and activity decreased, as might be expected;
- The infants' latency to sleep was shorter following the massage therapy study (by the end of the two-week period the latency to sleep decreased from 22 to 9 minutes);
- The infants showed increased vocalizations, decreased restlessness and improved affect during mother-infant play interactions, and the mother's play behavior became more age-appropriate;
- The infants' fussiness decreased after the two-week period; and
- The infants' depressed mothers perceived their "depressed" infants as being easier to soothe.

These data on decreased fussiness and more organized sleep suggested that we should conduct studies having parents massage their colicky infants and their infants with sleep disturbances. Thus, we are using the same model for those groups.

Grandparent volunteers as massage therapists

"Grandparent" volunteers offer another cost-effective way of delivering massage therapy to infants. (Our volunteers are not biological grandparents of the children, but simply retired people who would rather be called "grandparent volunteers" than "elderly volunteers" or "senior citizens.") They belong to an organization of volunteers and have had many years of experience with young children. In an ongoing study, grandparent volunteers are being trained to massage children who have been neglected and/or abused, physically and sexually, and are now living in a shelter.

The study is designed to measure the effects of massage therapy on both the children and the volunteer grandparents of their giving the massage. (The elderly, like young children, experience failure to thrive, probably secondary to touch deprivation.) Our objective is to reduce both the grandparents' touch deprivation and the infants' touch deprivation, as well to reduce any touch aversions the infants might retain from having been sexually or physically abused.

The infants in this study ranged in age from three to 18 months. Since the grandparent volunteers were their primary caregivers in the shelter for the morning hours, the massage therapy sessions were a structured program integrated into the infants' daily caregiving routine. The preliminary results suggest the following results for the infants:

- Drowsiness and quiet sleep increased and activity decreased following the massage;
- After one month of massage therapy, alertness and tracking behaviors increased; and
- Behavioral observations suggested increased activity, sociability and soothability.

For the volunteer grandparent massage therapists, a preliminary analysis of the data suggested that:

- The grandparent volunteers reported less anxiety and fewer symptoms of depression and an improved mood after receiving the massage;
- Their stress levels (measured by cortisol levels in their urine) decreased;
- Their lifestyle improved, with more social contacts, fewer trips to the doctor's office and fewer cups of coffee; and
- They reported improved self-esteem.

These effects appeared to be greater for the grandparents following a month of providing the infants with massage than they were following a month of receiving their own massages. These data suggest the power of massage therapy not only for the infants but for the adults who are massaging the infants, making it possible to cost effectively provide infants with massage therapy.

We have since discovered many other groups of infants who might benefit from massage therapy , such as those with cancer and spina bifida, as well as adults with different medical conditions that could improve from providing the therapy. The benefits of massage with normal infants, however, should not be overlooked, as often happens when so many infants have clinical problems needing treatment. Images of infants in Romanian orphanages remind us that children need physical contact for normal growth and development. Our culture's increasing restrictions on touching children (because of concerns about potential sexual abuse) may have severe consequences. In cultures and parts of the world without touch taboos, infants thrive (as do their parents) on this pleasurable physical contact.

The Touch Research Institute at the University of Miami School of Medicine is the first center in the world for basic and applied research on the sense of touch. Its primary aim is to further knowledge of the role of touch in health and development and application of that knowledge to medicine and the treatment of disease.

The Touch Research Institute opened in May, 1992, following a symposium on touch in infancy which featured Ashley Montagu, T. Berry Brazelton, Marshall Klaus, Gene Anderson, Edward Tronick, Saul Schanberg, Michael Leon, and Steven Suomi. The faculty/staff, comprised of 40 psychologists and physicians from the University of Miami Medical School, Harvard, Duke and McGill Medical Schools, and University of Maryland, are currently conducting 34 studies in this area.

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The Infant's Sixth Sense: Awareness and Regulation of Bodily Processes

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Life is a sensory experience. During every moment of our life we experience the world through our varied sensory systems. Sensory experiences drive our behavior and contribute to the organization of our thoughts and emotions. Immediately after birth, the infant is bombarded with a variety of new sensory stimuli. These provide important information about the characteristics and potential demands of the baby's new environment. The infant must immediately **detect, discriminate** and **adapt** to this information. Successful adaptation to the rapidly changing environment and the ability to cope with changing demands depend on the infant's ability to detect and interpret sensory information. Thus, when we study infant behavioral patterns, vocalizations and physiological reactivity, we attempt to understand how the young infant uses sensory systems to detect information from the environment, and to integrate this information into motor, affective and cognitive schema to successfully interact with the environment.

We have learned that humans have five primary sense modalities: smell, vision, hearing, taste and touch. We know that even a newborn can respond to smell, vision, hearing, taste and touch. These responses are obvious to the parent and clinician (although only a few decades ago, scientists were unaware of many sensory capacities of young infants). However, this traditional method of categorizing sensory information does not account for the vast amount of sensory information being conveyed to the brain from the numerous sensors located **inside** our body. Even current clinical models of infant regulation (e.g., Greenspan, 1992; Ayres, 1972) that emphasize the importance of sensory processing in the emotional and cognitive development of the infant, and individual differences among infants in the ease with which they detect and interpret sensory information, focus primarily on three sense modalities that describe the external environment — that is, touch, vision, and hearing. These models do not deal with internal sensations that provide information about the physiological regulation.

Although neurophysiologists and neuroanatomists describe sensory systems which regulate our internal organs, this research has had little influence on either our common language or the clinical terminology we use to describe bodily processes. At present, there are only a few easily understood descriptors that characterize internal senses and states — for example, pain, nausea and arousal. Yet, in spite of this linguistic handicap, our experiences provide us with an awareness of bodily sensations and an appreciation of how these sensations can contribute to mood state and psychological feelings.

Missing from our language and our science is the ability to describe internal states. In our day-to-day interactions we choose vague terms, such as "feelings" to describe the psychological consequences of bodily changes. Behavioral scientists often attempt to objectify these terms by operationalizing concepts such as state, mood, and emotion with verbal reports and elaborate coding systems. Clinical practitioners infer these feelings and use terms descriptive of emotional tone. However, whether we are talking about feelings, emotions, states, or moods, we are always attempting to describe the internal states that are continuously being monitored and regulated by the nervous system.

The goal of this article is to introduce an additional sense modality that monitors bodily processes. A variety of terms may be used to describe this sensory system. Classic physiology describes this sensory system as **interoception**. Interoception is a global concept which includes both our conscious feelings of and unconscious monitoring of bodily processes. Interoception, like other sensory systems, has four components:

1. Sensors located in various internal organs to "sense" internal conditions;
2. Sensory pathways that convey information to the brain regarding the internal conditions;
3. Brain structures to interpret sensory information and organize systems to respond to the changing internal conditions; and
4. Motor pathways that communicate from the brain back to the internal organs that contain the sensors to change directly the state of the internal organ.

Brain structures evaluate interoceptive information, categorize it, associate it with other sensory information, and store the associations in memory.

Interoception is the sixth primary sense

The five classic senses described above are categorized based upon the sensors located on the external surface of the body, or exteroceptors. However, we are aware that the external senses (e.g., vision, audition, sound, touch, smell, and taste) are not the sole source of stimulation directing the infant's behavior, thoughts, and emotions. The ability to sense internal states and bodily processes — through interoceptors located on the heart, stomach, liver, and other organs inside the body cavity — constitutes a sixth sense that is crucial to the infant's survival.

This sixth sense represents a functional awareness, with both conscious and unconscious dimensions, of what is happening inside the body. For example, on a conscious level, digestive processes may provide sensory information that the infant interprets as hunger when the stomach is empty, or as pain when the stomach is severely distended due to gas. The cardiovascular and respiratory systems also provide conscious feedback. Alertness changes as a function of shifts in both blood pressure associated with posture (when, for example, a baby brightens when picked up and held upright against a parent's shoulder) and blood gas concentrations of carbon dioxide and oxygen. On an unconscious level, internal organs have sensors which send continuous information to brain structures. This unconscious awareness fosters stability (i.e., homeostasis) in internal physiology by rapidly adjusting to support specific motor behaviors and psychological processes.

Although bodily sensations are paramount to the infant's successful survival, developmental specialists are currently more concerned with the infant's capacity to sense external stimuli. For example, clinical assessment tools, such as neurological and neuropsychological examinations, focus only on the processing of external stimulation. Similarly, our current childrearing and intervention strategies are not at all geared to helping young children sense their internal physiological states. We do not provide infants and young children with descriptive or symbolic tools to represent internal states, nor are caregivers taught to perceive specific behavioral or physiological indicators of gradations in the infant's bodily sensations. This remains the case even though we know that the status of bodily functions (such as digestion) and infants' reactions to difficulties in these processes (such as colic) are derived via important sensory systems. Moreover, the sensory information from continuously monitoring bodily functions can influence the infant's ability to perform specific behaviors, perceive external stimuli, and organize information into mental representation of cognitions and emotions.

Barbara Young

Evaluating sensory processing

For the five classic sensory modalities, we can evaluate the competence of the child to process sensory information by direct observation of behavior and through verbal reports. We can observe adaptive and dysfunctional strategies. We can identify problems by observing hypo-responsiveness and hyper-responsiveness in response to specific sensory challenges. We can evaluate developmental patterns in the child's ability to integrate sensory information. In addition, we can evaluate intervention procedures delivered by professionals such as speech and hearing specialists, ophthalmologists, nurses, occupational therapists, physical therapists, psychologists, psychiatrists, and pediatricians.

In contrast, interoceptive competence has not been systematized. Other than estimates of pain severity, there are no methods to quantify perception of bodily processes or to test unconscious interoceptive feedback. There are no scales to identify developmental landmarks.

But whether or not we know how to describe or measure them, sensations from inside the body are a strong influence on the infant's behavior in the world. From birth, the infant's need of sleep, food, water, and warmth are monitored via internal sensors. This information drives much of the infant's behavior. The infant's behavior then provides cues to the caregiver. In other words, stimulation of specific sensors inside the body of the young infant results in behavioral responses that prompt the caregiver to interact with the infant, to comfort and to reduce the cause of the bodily sensations. For

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example, feeding the infant reduces hunger, burping relieves flatulence after feeding, and sucking may stimulate digestion and reduce constipation.

Interoception: The infrastructure of higher-order behavior

Interoception is dependent on a complex feedback system that starts with sensors located in various body organs and ends with the higher-order social interaction with the caregiver. Faulty sensors or a dysfunction in any component of the sensory system (i.e., sensor, sensory pathway to the brain, motor pathway from the brain, or areas in the brain that interpret the sensory information and control the motor output to the organ) may contribute not only to physiological problems, but also negatively impact on the psychological and interactive experiences of the infant. Thus, the quality of interoceptive processes may contribute to individual differences in information processing (e.g., cognitive processes), emotional expressiveness, and social behavior.

I have conceptualized the dependency of complex behaviors on successful bodily processing in a hierarchial model with four levels (see Porges, 1983). Each level requires successful functioning on the preceding level of organization. Although the model includes complex social behaviors, the substrate of the model depends on the organizational competence of the nervous system.

- Level I is characteristic of homeostatic processes of physiological systems regulating the internal organs. Homeostatic regulation requires the bidirectional interoceptive process of monitoring and regulating the internal organ via sensory and motor pathways between the brain and the internal organ.
- Level II processes require cortical, conscious, and often motivated influences on the brainstem regulation of homeostasis.
- Level III processes are observable behaviors that can be evaluated by the quantity, quality, and appropriateness of motor behavior.
- Level IV reflects the coordination of behavior, emotional tone, and bodily state to successfully negotiate social interactions.

This model assumes that complex behavior, including social interactions, depends on physiology and how appropriately the nervous system regulates bodily processes. In this model, interoception becomes the foundation of physical, psychological, and social development. Interoception serves as the neuro-physiological substrate of the higher processes, included in Level III and Level IV, that have been elaborated by many other researchers, practitioners, and theorists of child development.

Level I processes: Physiological homeostasis

Underlying the vague concept of "feelings" is a physiological process that depends upon interoception. By explaining and measuring the functional regulation of physiological processes dependent upon interoceptive mechanisms, we can identify functional vulnerabilities in the infant's ability to regulate on the most basic level. If the infant is insensitive to his or her own bodily calls for care, nurturance, and protection, how will the infant appropriately function and respond to social needs?

Level I processes provide the physiological mechanisms for state regulation, including emotional regulation and expression. They also provide the infrastructure for the child's successful interaction with the challenging social demands of the world.

In the proposed hierarchial model, Level I processes represent the successful regulation of internal bodily process via neural feedback systems. To maintain homeostasis, interoceptors originating in the body cavity (e.g., gastric, hepatic, enteric, cardiac, vascular, and pulmonary systems) transmit information via nerves to brainstem structures. The brainstem structures interpret the sensory information and regulate the internal physiological organs. They do this by stimulating nerves that either directly control internal organs (e.g., increase or decrease heart rate, constrict or dilate blood vessels, inhibit or facilitate peristaltic activity, etc.) or indirectly manipulate the organs by releasing specific hormones or peptides (e.g., adrenalin, insulin, oxytocin, vasopressin, gastrin, somatostatin, etc.).

Level I is associated with the organization and neural feedback mechanisms that characterize the maintenance of homeostasis. These homeostatic processes can shut down when either internal conditions or external challenges require maximum output of energy. For example, fever, severe thermo-stress, extreme emotional distress, and aerobic exercise can reflexively inhibit Level I feedback systems. States associated with severe illness (e.g., physiological compromise and instability) are also characterized by a down-regulation of the neural control of bodily processes. Alternatively, up-regulation may occur when the interoceptors are directly stimulated (e.g., the filling of the stomach with food) or when other sensory modalities reflexively influence bodily processes. For example, the smell of appetizing food initiates signals from the nose to the brainstem structures that in turn stimulate glands in the mouth and stomach to produce digestive secretions even before the food enters the mouth.

Level II processes: Cost of doing business

The autonomic nervous system is the division of the nervous system that senses the condition of internal organs and regulates their activity. The autonomic nervous system deals with: 1) servicing the needs of the organs inside the body; and 2) responding to external challenges. We can define adaptive behavioral strategies and homeostasis in terms of the child's ability to trade-off between internal and external needs. Based upon this model, homeostasis and response strategies to environmental demands are interdependent. Homeostasis reflects the regulation of the physiological conditions within the body. Response

strategies reflect the stage when internal needs become less important than external needs — when the baby (fed, burped, and changed) is ready and eager to interact with the world of people and things.

The autonomic nervous system has two branches, the sympathetic and the parasympathetic. In general, the parasympathetic branch promotes functions associated with growth and restoration. In contrast, the sympathetic branch promotes increased output of energy to deal with challenges from outside the body. When there are no environmental demands, the autonomic nervous system services the needs of internal organs to enhance growth and restoration. However, in response to environmental demands, homeostatic processes are compromised and the autonomic nervous system supports increased output of energy, by down-regulating parasympathetic function and often stimulating sympathetic function to deal with these external challenges.

The central nervous system mediates the distribution of resources to deal with internal and external demands. Perceptions and assumed threats to survival (independent of the **actual** physical characteristics of the stimulation) may promote a massive withdrawal of parasympathetic tone and a reciprocal excitation of sympathetic tone. This trade-off between internal and external needs is monitored and regulated by the central nervous system.

Level II represents the integration of interoceptive systems with other sensory modalities and psychological processes. Unlike the reflexive integration described in Level I, Level II involves higher brain processes. Level II processes include voluntary approaches to the source of stimulation or an awareness of the need to problem solve and engage in information processing. To foster the contact with the stimulus or to process information, the internal bodily state is changed. Level II is characterized by the appropriate adjustment (i.e., gradations in inhibition) of homeostatic processes during states of attention, the processing of information, and social behavior.

When other senses — for example, hearing, sight, or touch — are stimulated, the autonomic responses are a secondary process. Under these conditions, after the baby detects sensory information, his brain structures regulate autonomic organs to facilitate the processing of the sensory information. These physiological states may support the baby's ability simply to pay attention to the sensory stimulus, or, by increasing metabolic output, the physiological state may support the child's physical movement towards or away from the stimulus.

Sensory information from the external environment triggers changes in internal regulation that are maintained via accurate interoception. Without accurate interoception, the down-regulation of internal physiological processes may compromise survival — for example, by inhibiting digestion or by disturbing electrolyte or blood gas levels. Defects in interoception may also be at the base of regulatory disorders (Greenspan, 1991). Regulatory disorders reflect a broad spectrum of dysfunction in young children and include difficulties in bodily processes such as eating and sleeping, difficulties in processing sensory and affective information, and difficulties in state regulation.

Physiological and behavioral homeostasis: Parallel concepts

As a construct, **physiological** homeostasis is consistent with the **behavioral** homeostasis observed by Greenspan (1992). Greenspan has described a developmental period from birth to three months during which the infant masters homeostatic processes. In this model, homeostasis requires the appropriate regulation of sleep and behavioral states as well as the ability to incorporate appropriate visual, auditory, and tactile stimulation. Thus, children defined as having regulatory disorders have difficulties in sleep, feeding, and sensory integration.

Greenspan's model, however, focuses on the external sensory modalities — hearing, sight, and touch. I am suggesting that physiological homeostasis (Level I) and the regulation of physiological homeostasis to support sensory processing of environmental stimuli (Level II) are necessary substrates for the behavioral homeostasis. In

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other words, the regulatory disorders defined by Greenspan may have a physiological substrate (Porges & Greenspan, 1991). Empirical research provides support for this hypothesis (e.g., DeGangi et al., 1991; Portales et al., 1992; Porges et al., in press). We are demonstrating that physiological measures of homeostasis are related to behavioral problems in infants. Our findings suggest the possibility that clinicians will be able to use physiological measures that reflect interoceptive competence diagnostically, to identify Level I and Level II vulnerabilities in infants and young children.

Assessment of Level I and Level II processes

In general, homeostatic processes are regulated by the parasympathetic nervous system via the vagus nerve, a large nerve with several branches enabling bi-directional communication between brain structures and internal organs. The vagus, with its sensory and motor pathways, is the primary component of the interoceptive system. The vagus and its branches account for approximately 80 percent of the parasympathetic nervous system. Approximately 70 percent of the vagal fibers are sensory, and thus, directly service interoceptors within the body cavity. Thus, measurement of vagal activity provides information on interoception in maintaining homeostasis (i.e., Level I processes) and the regulation of homeostasis to support environmental challenges (i.e., Level II processes).

It is possible to monitor vagal activity by quantifying specific rhythmic changes in heart rate (see Porges, 1992). Level I processes may be evaluated by measuring vagal control of the heart during rest or sleep; this provides a measure of the infant's interoceptive capacities to maintain homeostatic control. Level II processes may be evaluated by measuring the change in vagal control of the heart during environmental challenges; this provides a measure of the infant's capacity to down-regulate the vagal system to deal with environmental demands.

Our research program provides data supporting the hypothesis that the ability to sense and regulate internal physiological state is at the base of competencies in higher-order behavioral, psychological, and social processes. Currently, we are developing laboratory procedures to profile the infant's capacity to regulate internal physiological systems during a variety of sensory processing demands. Our long-term goal is to provide a standardized clinical instrument to evaluate interoception. This instrument would complement neurological, neuropsychological, and other sensory evaluations. The assessment would index interoceptive processes through the measurement of heart vagal influences on the heart (i.e., cardiac vagal tone). The instrument will have the capacity to evaluate two dimensions of interoception:

1. The capacity to monitor and maintain homeostasis in the absence of environmental challenges (i.e. Level I processes); and
2. The capacity to alter homeostasis to support behaviors required by environmental challenges (i.e., Level II processes).

The ability to measure interoception, the sixth sense, opens a new window to the infant's sensory experiences. This window allows us to observe and to understand the internal feelings of the infant and how these internal states change during illness, mental processing, and social behavior.

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Sensory Contributions to Action: A Sensory Integrative Approach

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When we think about sensation, we usually think about the subjective experience - how something "feels". We also tend to think about the five senses: vision, hearing, touch, taste and smell. But the hidden senses - the balance sense (vestibular system) and muscle sense (proprioception) - are also important if we are to understand how infants use sensory input to frame their actions. The purpose of this article is to explore how all of the sensory systems contribute to action during infancy.

I will be discussing "action" not motor behavior. Motor behavior is the execution of a body movement which may, or may not, be goal directed. Action is more complex. It can be thought of as formulating a goal, planning or sequencing the movements and finally executing the action sequence. The difference between motor and action is the difference between a single reach and exploratory play. The reach is necessary for successful exploration, but there is much more complexity in successful exploration. A complete discussion of the organization of action, or even the sensory contributions to action, is beyond the scope of this article. I will discuss just three aspects of this complex relationship that are central to the development of action in infancy; (a)how sensory registration contributes to choice of action, (b) how sensation contributes to planning action, and (c) how sensation contributes to the actual "doing" or execution of a series of movements. These processes will be illustrated through descriptions of free play in 9 month old infants. This discussion is based on the work of Ayres in describing the theory of sensory integration (Ayres 1964, 1972; Fisher, Murray, & Bundy, 1991). Sensory integration is the organization of sensory information to enable the child to act on and interact with the environment. Sensory integration, like temperament, can help us to understand some of the individual differences in exploratory style seen in typically developing infants, as well as give us insight into some of the subtle clinical problems seen in children referred to early intervention programs.

Sensory contributions to choice

Choice of action is based on many different processes such as cognition, mastery motivation, perception, environmental affordances, experience, etc. . Sensory registration precedes these processes. It is the ability to modulate attention and arousal in response to sensory input. I can feel you touch me, it alerts me, but does not hurt or overstimulate me, and I like it (or don't like it). It is the precursor to perception, cognition, and self regulation. Sensory registration has both an arousal and an affective link (Ayres, 1972; Greenspan 1992). One way to think of sensory registration is in terms of preferences and regulation of response. Julie likes soft furry toys, but Laura avoids them. Chris loves bath time and playing with his food, while Jason becomes irritable, hyper-alert, and inconsolable during his bath. These preferences can guide choice in play or interaction. Exploration and play in infants occurs in the presence of moderate or low novelty and low stress (Rubin, Fein & Vandenberg, 1983). If a child enjoys a particular sensory experience that experience will be perceived as a possibility for exploration. If the sensory experience is not a positive but evokes fear or discomfort, both stress and novelty are increased and the experience will either be avoided or result in behavioral disorganization.

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Sensory preferences are thought to be constitutional (DeGangi, 1991) and can be observed as early as the first week of life (e.g. cuddliness in a neonate, preference for prone vs supine, orientation to auditory vs visual on the NBAS). They can be observed in play preferences (e.g. enjoyment of rough-housing, tickle games, walking on the beach), food preferences (e.g. the transition from pureed to textured foods) and social interaction (e.g. enjoyment of affectionate touch).

Ayres (1964) first discussed sensory registration in relation to the tactile system when she described tactile defensiveness. Tactile defensiveness is observed when children exhibit fear, avoidance, or aggression when touched lightly or unexpectedly. It is also possible to observe similar responses in other sensory modalities (e.g. a fearful response to loud sounds, bright lights, movement or position changes). The exaggerated response to sensory input appears to be state related. If a child is tired or stressed, there is increased likelihood of an aversive response and, conversely, if the child is comfortable and well rested he may be better able to enjoy sensory exploration.

Another way of understanding some children's anomalous response to sensory input is in terms of sen-

sory modulation (Royeen & Lane, 1991; Stallings, 1993). Sensory modulation occurs in all sensory modalities. It also has two poles: under responsive (sensory dormancy) , and over responsive (sensory defensiveness). Most of us can modulate our response to sensory input without either over or under arousal. The child with tactile defensiveness is readily over-stimulated by touch and either avoids touch or has a very pronounced negative response to it. The child with gravitational insecurity (poor modulation of vestibular input) may seem fearful in prone or standing, or cry during rough-house play. Children with gravitational insecurity may seem to take a long time to transition from creeping to walking because they are hesitant to "test" their balance in standing, and may prefer fine motor or pretense play to gross motor activities.

Some children are under-aroused by sensory input (sometimes referred to as sensory dormancy). Children with sensory dormancy frequently have a long latency before responding to stimuli, need more input before initiating a response,or seem to be unaware of the possibilities for action in the environment and in social relationships. By the time they do respond, the opportunity for action may have moved on. Play in a child with this type of response to sensory information is frequently described as aimless or passive. They seem content to watch the action, rather than participate in it. Tamara was a child with sensory dormancy. She would quietly watch the other children in her day care center while leaning against the wall. She was rarely able to initiate and sustain attention in any play activity. However, if she participated in rough-house play, swinging, or trampoline activities early in the group, she seemed more alert and capable of initiating exploration. Tamara's response to vestibular and proprioceptive activities was not unusual; many children with sensory modulation disorders do seem to be more responsive after a *self-directed* "jump-start".

Faith Bowlus

The influence of sensory modulation on exploration is clear. Sensory registration can influence the child's preferences and choices for action. While the emphasis of the preceding discussion has been on independent action, sensory modulation clearly influences social interaction as well. Parents expect (and need) their child to respond in predictable ways to their touch and playful holding. Stern (1985) described touch and proprioception as the foundation for attachment. Greenspan (1992) considers the regulation of sensory experience as the first step in communication and affective interaction. Parents of children with sensory modulation disorders need help to understand and adjust their child's "sensory diet" (Wilbarger, 1984). Descriptions of sensory modulation, the reason for their child's sensory avoidance or seeking behaviors, and ways to help the regulate their responses to sensation can help parents understand and modify their child's responses and their experiences.

Sensory contributions to planning action

Have you ever watched a child learn a new skill such as climb up onto a chair, or open a present? The process is usually slow, involves knowing what you are trying to do, some repetitive problem solving, and some motor strategies. These unfamiliar new tasks require praxis. Praxis is the ability to plan and carry out a non-habitual sequence of motor acts. According to Ayres (1985),"praxis is to the physical world what speech is to the social world. Both enable interactions and transactions.(p.1)" It enables one to interact creatively with your environment: to explore, to play, to change the environment if desired. It is necessary for, but different than, coordination of movement. Praxis is a cognitive process, but is based on a sensory knowledge of the body and the environment and sensory memories of prior motor learning (Ayres, 1985; Cermak, 1991; Schmidt, 1991). This sensory knowledge, or functional model of the body, is your body scheme. As an infant is learning to reach, sensory feedback is generated from muscles and joints (proprioceptive input), from the skin (tactile), and from vision. All of this sensory information contributes to the development of body scheme. This sensory-based body scheme is central to planning action (Ayres, 1985). I can "figure out" how to do a new and unfamiliar action because I know how I have moved in the past and I know what possibilities for action I possess. The child learning to climb up onto a chair is actively sequencing and trying out new strategies (the cognitive process), but those strategies are based on a subconscious awareness of how strong he is or how tall he is (the body scheme).

A child with poor sensory awareness and perception of movement will have difficulty forming a body scheme (Ayres, 1972, 1985; Cermak, 1991). Planned sequences or strategies for action based on a poor body scheme are inaccurate or clumsy. Learning a new task based on a poor body scheme is slow, but possible. However, children with motor planning problems do not seem to be able to

learn from experience or to integrate their new motor learning into their body scheme. The learning does not generalize. When a similar task is attempted new and unique strategies may be attempted.

Another "scheme" that is used in planning an action is an environmental scheme (Fisher, Murray, & Bundy, 1991). The enviromental scheme is a spatial map of the environment based on vestibular and visual input obtained from moving through, and in, the environment. I know that the chair is high, because I have climbed up on it. I know that I can fit behind the chair, but not the sofa, because I have tried it. I know that the room is the same if I enter from the door on the right or door on the left.

Jared is 18 months old and is just learning to run. He takes immense pleasure in the "doing" of his new skill. He repeats it over and over again, doing it differently each time. But when he encounters a new carpet surface he slows down. The process of changing to accommodate the new surface is clearly slower, and a problem solving process. But he attends to his goal - getting across the carpet - not his body, as he learns to negotiate the challenge. The next time the runs onto the carpet he is readily able to negotiate the challenge without thinking. Jared's motor planning is successfully based on feedback. The task of running on a carpeted surface no longer requires a new motor plan.

Chris, in contrast, does not seem to benefit from variability of practice in walking and running. Any obstacles, such as a carpet or toy in his pathway, are either ignored (resulting in a fall) or slowly figured out. Children with motor planning deficits will frequently use language to try to talk their way through the action rather utilize strategies based on subconscious body awareness or active problem solving. For Chris, practice is "work". He does not seem to get the pleasure out of repetition that Jared did. And, he does not seem to benefit from it the way Jared does.

Sensory contributions to "doing"

I have discussed how modulation of sensation contributes to choice, how the sensory-based body schemes contributes to planning an action, but sensation is also involved in the process of successfully executing a movement. Motor control theorists (Stelmach, 1982) discuss the role of sensation in movement using the engineering metaphor of closed and open loop systems. An infant is learning to control movement is using a closed loop system. Sensory feedback closes the loop . I begin the movement knowing what I choose to do. Using proprioceptive (muscle), tactile, vestibular, and visual information I am aware of my movement. If necessary, I can change the way I am moving to insure accuracy. "Muscles tell you lots of things about your body. ...They let you know how wide to open your arms to catch a ball.....They let you know just how to hug a puppy; if you squeeze too hard, the puppy will wriggle right out of our arms! (Koomar & Friedman, 1992, p.9)." Young children rarely have graded movement. They inevitably squeeze too hard, kick too soft, or touch too heavily. Over time, based on what their "muscles tell them" and how successful their actions are, they learn how to grade touch.

Play: Observations of sensory integration

Individual differences in free play can reflect individual differences in sensory integrative abilities. During free play children spontaneously express their sensory processing abilities. They must use sensory registration to orient to the possibility for action, plan a sequence of actions to explore the objects or environment, and finally execute the plan. Two 9 month old infants with development at, or above, age level on the Mullen Scales of Early Learning (Mullen, 1989), and similar developmental play ages (Belsky & Most, 1981) will illustrate these individual differences in play. By 9 months of age infants have developed adequate motor maturity to enable exploration unconstrained by motor immaturity (Bard, Fleury & Hay, 1990). They can act on their preferences and develop their own "style" of exploration. Both children were observed in their own home with their mother present. They were presented with a group of novel toys (e.g. dump truck, container with small manipulatives, doll with cup and brush, telephone, small stuffed animal) and were allowed to play independently for 7 minutes before being joined by their mothers.

David was an engaging child who smiled readily at me as soon as I entered his home. He was very interested in the toys I brought and began actively exploring them as soon as he was placed on the floor. He quickly manipulated each toy, discovering unique properties . He eventually focused on the telephone, which he explored for about two minutes: dialing, rolling, feeling the cord, hitting, "talking" on it, etc.. He did very little mouthing and used many different information gathering strategies. His sensory registration and planning happened effortlessly. He was able to modulate his touch to enable tactile exploration of the different textures afforded by the toys (though he preferred the hard telephone to the soft stuffed animal). David's play was not only effortless and diverse, it was also fun. He periodically looked up at me and laughed, seemingly trying to engage me in the playful exploration.

In contrast, Anna seemed visually engaged with the objects before being placed on the floor; however once she was on the floor she continued to look and not begin active object exploration. After about 30 seconds of wide eyed looking at the toys, she began to reach towards the objects. In contrast to David's differentiated manipulation, Anna did the same thing to all objects. She would pick up the toy with her fingertips, briefly mouth it, then drop the toy. After dropping several objects, she wiped her open hands on her shirt (as if to wipe off the feeling) then picked up the next object, mouthed it, dropped it, etc. After about 4 minutes of this "hot potato play," Anna began to look towards me or her mother for social play. She

seemed easily overstimulated and stressed by the novelty and sensory properties of the objects, and needed some help to organize her response to the play situation. She did not seem to be having fun. Even when joined by her mother, Anna continued to have difficulty exploring the toys. Her mother was able to "teach" her how to put objects into or take them out of a container, but had difficulty in helping her to modulate her response to touch, or to plan a strategy for exploration. Anna's play can be viewed in two ways: as an expression of individual differences in preferring social to object play, or as a problem in sensory registration or motor planning that required either direct intervention or parent education so her parents can better understand and support her exploratory attempts. After the play session, Anna's parents indicated that they were concerned about her play, attention, and her sleeping and feeding patterns. These concerns and observations are consistent with both with sensory integration (Fisher, Murray, & Bundy, 1991) and regulatory disorders (Greenspan, 1992). Sensory registration and motor planning were explained to them to help them understand what Anna liked (movement and social language play), what she did well (work within adult imposed structure), and what she had difficulty with (different textures, too many new objects, regulating her own response to a complex task). In addition they were given some ideas about how to support her own capacity for sensory modulation and having fun during play (modifying the environment, following her lead during play, some firm touch and vestibular play).

David and Anna provide a useful contrast to illustrate the role of sensory integrative abilities in organizing a response to environmental opportunities. Within the structure of a standardized test, both children had comparable abilities. During self-directed play that requires self regulation of arousal and attention and independent ideation and planning, they are very different. Sensory integration, the organization of sensory information for use, is essential to self-directed exploration. This organization has been illustrated in three different ways in this article; first through registering the sensory input and regulating arousal and attention to it, second by formulating a goal and plan for action based on a sensory-based body scheme, and finally, by modulating motor actions based on previous and concurrent sensory feedback of movement. A child may be able to effortlessly integrate all three of these aspects of action, like David, or may, like Anna, have a problem in any one of them that may interfere with functional interaction with the child's physical and social environment.

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21

Sensory Experiences in Infancy

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Healthy babies come into this world beautifully equipped to get acquainted with it and to discover how to use it to meet their needs. They have been hearing sounds within their mothers' bodies and also sounds that penetrate the womb from the outside world. Babies recognize frequently heard sounds — including their mothers' voice and their parents' favorite music — and prefer them after birth, as they may later prefer familiar sights, smells, tastes, and textures. Babies come into the world prepared to enjoy what is novel as well as what is familiar. They pay more focused and intense attention to new stimuli, especially those coming from the human world. A complex drawing receives more concentrated attention than a simple color; infants give their most intense attention to a drawing — or even a schematic approximation — of a human face.

The baby uses its senses both to get acquainted with the environment and to achieve comfort, and every baby goes about this differently. Once I visited a hospital and put three "boarder babies" in succession back in their cribs after a feeding. One baby relaxed, sucking his thumb. Another kicked at a balloon hanging on the foot of his crib. A third focused on pictures on the wall. (One baby had no resources for self-comfort, and I told the social worker that he needed immediate placement in a family. She found a family with children who played with him, and he brightened up.)

Infants and young children vary greatly in their interest in different sensory areas, in the intensity of their attention to sensory stimuli, and in their sensitivity to feelings of comfort and discomfort, familiarity and strangeness, and the emotional context in which sensory experiences occur.

As I have recalled in earlier *Zero to Three* articles, in past years I visited many baby centers with bare walls, with nothing for babies to look at or explore — places where lack of sensory stimulation impeded infants' development. Today, in this country, I am more concerned about helping parents and caregivers become more aware of individual differences among babies' preferences for sensory experience. The individuality of infants' and children's sensory sensitivities and sensory-motor relationships can create problems if their caregivers are guided by "prescriptions" for each age level and have little time or interest in exploring the differences among children. Children's interests do not always match "age-appropriate activities."

Here are one mother's memories of the sensory responses of her baby:

> Carl's responsiveness was apparent at birth, when he started kicking during an interview between the doctor and me. He had had a natural birth with no anaesthesia, and he was very alert, looking all around, looking at himself in a mirror. He reacted to TV changes. At two months, when I brought him a little sheepskin blanket, he wiggled and moved around as if to increase the feelings it gave him. At three months, he imitated my head-waving.

Dale Gelman / Photo Agora

Some little children are very much interested in the natural world. My seven-month-old grandson would stretch out his hands and arms to catch a sunbeam as he sat on the grass under a tree. His older sister, at nearly two, would happily run with arms stretched out to catch a breeze! Another little child was fascinated with the moons she thought she saw from inside her house. "Two moons!" she insisted, as her grandfather held her first at one window, then moved to the next window. She could not accept his correction — that it was the same moon she saw through the two windows. In other words, perception of a sensory stimulus in the first two years is not clearly distinguished from the context in which it is seen.

Some infants and toddlers find their greatest satisfaction in sensory experience of the human world. At four months, Ellen kicked and laughed in excitement as her adoring grandmother approached her. Jennifer, at the same age, showed bouncing delight when she heard her father's footsteps. As adults, both women continue to show affection intensely and vigorously.

Even very young children have definite preferences for play materials. Al's nursery school teacher told his

parents to give him playthings suitable for his age, such as blocks. Al already had blocks, but ignored them; he did not care for them at all. He liked colors, in crayons and paints. Kevin, however, loved blocks from his earliest years and later remembered with delight all the things he could do with them — make roads, bridges, houses, whole towns. Blocks were the beginning of his interest in wood, in learning to create tables and other things out of wood, an interest that persisted into adulthood. (Al never developed an interest in making things. He became absorbed in music, then books.)

Continuity of sensory interests

In some cases, a strong sensory interest in infancy is deeply rooted and develops into a life career. This occurred with Kim, who tried at seven months to catch a sunbeam. He continued to be interested in aspects of light. At 13, he longed to make a laser. He read about the process at length and told me wistfully that he knew he could make one, but he didn't have the $75 he needed for a ruby rod. I added up birthday and Christmas gifts and gave him the $75; he made the laser. His school gave him an "A" on the project but paid no further attention. The next year, Kim became interested in photography and made photographs of the graduating class. He later entered military service, studying electronics. He continued his self-education until he was lecturing MIT students even though he had not had a college education himself. Kim's absorbing interest in light in various manifestations predominated over all other interests.

Other children's early sensory experiences seem clouded by the emotional context in which they occur — also with long-lasting consequences. Unique among all the children I watched from infancy to adulthood was Kenneth, the youngest of seven children in a family where the first two mothers had died from infections before antibiotics were in common use. Kenneth was chronically anxious and appeared anxious when there was nothing to be afraid of — no immediate fearful stimulus, that is. But the atmosphere in the family during his infancy was full of anxiety because the father had lost the last of the series of professional appointments he had held. Both of Kenneth's parents were regularly working until midnight writing a book to supplement the father's income, and his mother was tired during her whole pregnancy with him. Although on the surface Kenneth's early sensory environment was not unusual, the anxiety-laden emotional context of his sensory experience may have been crucial in shaping his response.

I have known Kenneth for his entire growing up. In his visits to me, I validated his perceptions. His mother did not understand Kenneth's extreme sensitivity. Because she rejected my comment about it, I did not attempt to continue exploring this with her. Kenneth now says that we have been "buddies." He has spent his life trying to "get stronger," through exercises, rolfing, and Zen, among other things. Kenneth remains chronically extremely sensitive, but is also determined and has developed into a very creative, versatile, helping person.

A more fortunate child was Jeremy, typical of those babies who are gifted in certain areas of sensory experience and expression at the same time that they have difficulties in other areas. Jeremy was extremely sensitive to touch and definitely resisted having his face washed, nose cleaned, or hair cut. His balance was poor, and he did not walk until 18 months. However, this child loved listening to music and his parents' conversation. By 14 months he knew 200 words. Jeremy's parents were not upset by his limitations — they respected them, and tried to avoid disturbing him while they supported his good areas of functioning.

Jeremy's good language led to early reading and easy mastery of school tasks, while his sensitivity to contact prevented him from getting into body encounters with other children. He was not a fighter, but he was a good actor in school plays. He also had a good voice and as an adult loved to sing Gilbert and Sullivan songs in community shows.

Quality of attention

The **quality** of the child's attention is important as an expression of what the experience means to him. The clarity of focus, the length of the attention span, the degree of absorption all convey something to the observer of what the child's perception means. Little Stevie's way of looking was **intense**, as if he were trying to fathom the meaning of the object he was observing. This intensity continued as his scientific interest developed, until, as an adult, he was working on microscopic studies of DNA. While some children's intense interests are related to talents, others have different roots. Louise loved trees. As a baby, she lay in her perambulator watching sunbeams shining through their branches. This pleasure continued into adulthood, as she watched the shifting sunlight in trees around her country house.

Babies differ in the **number** of their intense interests. Al was absorbed in music; Molly was intensely interested both in music and in colors; Midge loved music and colors and rhythmic movement. All of these children were gifted in these areas.

Not surprisingly, parents and grandparents are sometimes especially alert to the special quality of a baby's attention. The mother of a two-day-old baby was holding her as the baby gazed intently at her mother. The grandmother said, "She doesn't look at me like that — I think she recognizes you." A two-month-old baby stared intently at his hands, twisting and turning them as his parents and their pediatrician talked. His mother commented, "He has just discovered his hands."

Often, the excitement of a sensory experience arises from a baby's ability to control it. In the early months, mobiles suspended in the crib are interesting because they move or make a sound when the baby touches them. As soon as a baby can sit up in a tiny bathtub, floating toys

that move in response to the infant's splashing are a source of delight. The eight-month-old in a high chair soon discovers the fun of grasping a spoon and dropping it over the edge of the tray, retrieving it by a string or having it restored by the caregiver (of course, at this age, games of disappearance and reappearance are fascinating.)

Familiarity and strangeness

Sensitivity to strangeness can be either a response to something that is actually strange — that is, completely different from what the child is accustomed to — or it can be simply a response to a **new** experience, not really different from the child's usual experiences. For some children, nothing feels strange; for others, every new experience, every new person, is strange.

Adults may easily underestimate young children's ability to discriminate between the familiar and the strange. At eight months, our baby boy loved a Czecho-Slovak dance record and wanted to hear it over and over. At three years, he asked his grandmother to play a "Beethoven record." But when she put on the Fifth Symphony, he whimpered, "I wanted the **Sixth** Symphony!"

A given objective stimulus is experienced differently by different babies. Sudden noises — an automobile honk, a doorbell, a slamming door — is a source of curiosity for one baby, a cause for alarm for another. Some babies sleep comfortably anywhere; others are restless unless they are in their own familiar crib. A six-week-old baby boy refused to nurse after his mother had been jogging. The exercise had produced lactic acid, which is secreted into the milk and affects its taste. When this mother gave the baby previously pumped milk, he accepted it.

Some babies seem instantly at home in the world. A three-month-old who visited me in my home for the first time laughed joyously, as if I were a beloved old friend. In contrast, Nina was a sensitive little thing. Sitting in the curl of her mother's right arm, she looked wide-eyed at the incomprehensible world, which never seemed to become more comprehensible. Her wary expression never relaxed.

Adult responses to babies' sensory experiences

As an active baby reaches to touch objects in the environment, he encounters things that give him pleasure or pain. He learns what is "out there," and he also discovers what he likes and dislikes. Babies experience feelings of pleasure and pain in different areas, and at different levels of intensity. Steve was very sensitive to textures as a tiny boy — any woolen pants had to be lined to protect against the feeling of the wool. At the same time, he loved soft surfaces, such as that on a fuzzy teddy bear.

Some babies are not very active — they don't reach, grab, or play — but they do spend a lot of time watching everything that goes on and listening to all the sounds they can hear. When a baby stares or watches quietly, he is taking in a great deal. We may say, "He doesn't miss a thing." Some preschool children spend a great deal of time in any new situation surveying all of the possibilities. When they go into action, they are selective, using observations they have stored up. The quiet child who takes in everything may reflect what has been going on in his mind in his creative productions; these may be more original or more complex than those of the active children.

The baby's parents and other caregivers restrain or encourage her in her active exploration or quiet observation of the world. When the infant finds books to pull out of the bottom shelf of the bookcase, a concerned grown-up may replace the book with a "No! No!" and a shake of his head. But when the child pulls out pans from the low cupboard in the kitchen, she is greeted with approving smiles. The baby is reproved when she puts certain things into her mouth to explore by licking or biting. Yet her smearing baby kisses on mother's hand are greeted with her kisses and smiles. In these and other ways, the baby's world is shaped — she learns to use her senses selectively, in ways approved by her culture.

The ways in which parents introduce their babies to sensory experience and respond to their children's unique sensory preferences, gifts, and sensitivities are linked, of course, to their own early experiences. I recently asked a woman whom I have known since her own infancy (and who is now the mother of a four-year-old boy) to reflect on how she had responded to sensory input as very young child. Here is what she wrote:

Subjects and Predicates

I have this image of myself as a very observant child, pretty quiet and on the edges. I think I felt very comfortable generally and new things could be around me and I wouldn't get flustered. I would just wait to see what would turn up. I don't think I overreacted or in fact reacted too quickly to new input.

But I also have an image of getting very excited — jumping up and down — somewhat losing myself or losing control and then getting overwhelmed so I'd have to stop. If I was suddenly the center of attention I could get this way, but I'd have to stop fairly soon.

The level of comfort seems most important. I'm sure I felt solid in my family, held often, read to often, presented with information or toys on the floor at my level. We had carpets, and things were pretty relaxed for jumping on or playing with.

I remember smells of garden, dirt, raspberries, my mother's flowers, and tortillas from Nonnie and water play in buckets and sprinklers — the cool on very hot days. I used to like to get very wet. I always loved the water, I think, and liked that kind of sensory connection.

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Touch was always positive, so sensory input through touch was welcome and I felt trustful. I think I liked to pick up things on the ground. I know I liked to eat sand, dirt, and grass.

I don't remember my own breastfeeding, but I remember snuggling up to my mother and getting to be next to her when she held or breastfed (my sister), and I remember getting to sit up carefully on the living room sofa and hold my baby sister.

Going places, I seemed to like to explore, and I don't remember if I needed to stay close to an adult. Of course there was always my brother, who could protect me if I wandered. I followed him without question.

I don't remember being startled or frightened. Even thunderstorms/tornadoes were an adventure. We'd take blankets, pillows, and stuffed animals down to the basement with a radio and flashlight. I remember Mom coming in at night whenever we called or were frightened, and lying down with us until we fell asleep again — thunderstorms became even cozy.

Of course I had nightmares, but Mom would always appear. (There's a lot to be said for consistency and trust — isn't there?)

(My son) seems to seek out sensory experiences more than I did. He's very independent, actively engaging with people — children and adults — to establish connection and a place. I think I am much the same kind of mom with him as my mom was with me — lots of hugs, new experiences at his level, talking to him about what to expect, asking him what and how he feels, being there always when he calls, creating safety as much as I can.

Sensory experience and development

The senses constantly guide, stimulate, and reward the actions of the baby. Senses and motor behavior cooperate. Neither can function without the other. Looking depends on movement of the eyes from birth, and soon, the head and body, as the baby turns or stretches to see new objects, or to hear a new sound.

As babies watch and listen to what goes on around them, they soon go beyond a reflex reaction to what they see and hear and touch and taste and smell. They discriminate between shapes and sounds and learn what to expect and what to reach for. They formulate whole images by synthesizing sensory information and in time, toward the end of their first year or early in the second year, connect these images with words, so they can begin to ask for what they want. But the process of connecting words and images is much slower than the development of the images themselves. The baby recognizes mother long before he becomes able to call her.

Babies become more active in using their senses to find comfort. An anxious six- or eight-month-old finds that **being held** by mother or another familiar caregiver is reassuring in the face of strangeness. Several months later, the toddler discovers that **holding** a familiar blanket or toy helps to maintain feelings of security in new situations.

Sensory experiences tell us who we are and where we are. The accumulation of images seen and heard, tasted, touched and smelled build a complex image of his surroundings in a little child's mind. Even a very young child invests a new sensory experience with personal meaning. "Granny!" was the enthusiastic greeting of a three-year-old I had never met before when, in my sixties, I visited her family. The child saw that I was an old lady, a "granny."

What the child has enjoyed most in the earliest years of life may be deeply cherished and held in long memory. Some adults re-create their earliest sensory experiences in music, painting, and literature. Some continue or elaborate their early sensory experiences in their occupations, domestic arts, and religious observance. Some guide new generations of babies and young children as they explore the comforts, delights, and wonders of the world.

Point of View

An Earlier Head Start: Planning an Intervention Program for Economically Disadvantaged Families and Children Ages Zero to Three

Edward Zigler and Sally J. Styfco, Yale University

In 1965 project Head Start began what was to become America's greatest experiment in enhancing child development. The program was created to foster academic readiness in young children whose prospects for success in school were dimmed by poverty. Instead of taking a strictly pedagogical approach, Head Start provided a broad range of services to children as well as their families. Over the years these strategies have proven to be effective. Millions of Head Start graduates have entered school healthier, more competent, and better prepared to learn; their parents have acquired better child-rearing skills, become involved in their children's education, and many have enjoyed a better quality of life.

For at-risk children to have a genuine head start toward school success, intervention must begin prenatally and continue throughout the early years of life.

In addition to benefiting participants, the Head Start experiment has inspired new areas of study dedicated to optimizing the development of economically disadvantaged children. The fields of early childhood intervention and family support have blossomed, early childhood education has become increasingly sophisticated in theory and methodology, and advances in pediatrics and developmental psychology have aided our understanding of how poverty impedes the developmental process. The knowledge accrued is now complete enough to aid the design of more effective interventions.

The most important insight gained from this body of evidence is that child development is a continuous process: physical and psychological growth build upon earlier stages, and each stage influences the next. There is thus no magic period during which we can inoculate children against the developmental threats imposed by poverty. Intervention during the preschool years is certainly important in preparing children for school, but the social and emotional foundations for learning have been laid long before this age (see *ZERO-TO-THREE*, 1992). A program must therefore begin early enough and last long enough to build a solid foundation for future development.

Although we have learned a great deal about how to deliver effective services to at-risk children and their families, this information has not yet had a meaningful impact on social policy. Recent laws promote expansion of Head Start's preschool program model but give short shrift to the need for early and developmentally continuous services. This is a grave oversight that will impede progress toward our national education goals and do nothing to improve the life outcomes of millions of children who, after spending their entire young lives in poverty, arrive at our Head Start centers too late.

The wisdom of prevention

Although the preschool component is the largest part of Head Start, the program has been a national laboratory for the development of ways to serve very young children. Just 2 years after Head Start began, 33 Parent and Child Centers (PCCs) were opened to provide supportive services and parent education to families and children from birth to age 3. Other efforts to reach younger children include the Parent and Child Development Centers, the highly successful but discontinued Child and Family Resource Program, and the new Comprehensive Child Development Programs (CCDPs)—all designed to provide health care and developmentally appropriate learning activities as well as family support and opportunities for parent participation. Related initiatives are the Head Start family day care and the Indian and Migrant Head Start programs. These efforts all tend to be preventive rather than remedial, aiming to reach disadvantaged families of very young children before developmental damage occurs.

The wisdom of this approach has been verified throughout the professions of health, psychology, and education. Preventive health care, for example, has been shown to be highly cost effective. Maternal nutrition and prenatal care unarguably reduce low birth weight and defects in development at great savings of both money and human potential. Family support and parent education have been shown in countless studies to be effective means of promoting healthy functioning in families of young children.

The social policy implications of this work are clear: A nation committed to having all children enter school ready to learn must do more than offer them a preschool program. For at-risk children to have a genuine head start toward school success, intervention must begin prenatally and continue throughout the early years of life. Head Start has long attempted to develop ways to serve very young children, and today's knowledge base confirms the need to expand this effort.

Designing a federal Zero-To-Three program

Given the overwhelming evidence, there is no need to provide a rationale for offering early childhood services

to at-risk groups. What is needed is a plan to refine and deliver these services. A wealth of professional expertise has been devoted to this task. Theorists and researchers from many disciplines have mounted and evaluated a variety of zero-to-three programs. Some of the nation's most respected professional organizations, advocacy groups, universities, and private foundations have sponsored countless panels and reports on the need for a federal effort on behalf of young children and have put forth inspiring plans to achieve one. With this momentum, coupled with the knowledge and dedication represented by this cadre of experts, our society today has the most promising opportunity we have had since 1965 to attempt new ways to address the ills of poverty and the causes of school failure.

Our long experience with Head Start is another invaluable resource. The experiment taught us not only about effective methods of intervention but about how to implement a national service delivery program.

Planning the program

Head Start was developed by a committee of 14 scholars drawn from a variety of disciplines. This format worked well, and a similar committee should be assembled to design a national program for very young disadvantaged children. The committee should also be charged with naming the new effort.

At the time of Head Start's planning, interdisciplinary early childhood intervention was virtually untried; now there are many well-designed experimental projects and much expertise that can inform the direction of the program. As just some examples, members of the American Academy of Pediatrics, the Carnegie Task Force on Meeting the Needs of Young Children, the Child Care Action Campaign, the Children's Defense Fund, the National Association for the Education of Young Children, and **ZERO TO THREE**/National Center for Clinical Infant Programs have experience in this area. We strongly recommend that the committee represent a variety of professions, a composition that gave Head Start the comprehensiveness that is its strength.

To chair the committee, precedent suggests the first lady is an ideal choice. Lady Bird Johnson served as the honorary chair of the Head Start committee, and her efforts and support were very important in putting the program into place. Hillary Rodham Clinton's background in child and family issues, and her desire to be the national spokesperson for children's concerns, are qualities perfectly matched to this new effort.

While we want to repeat the successful elements involved in Head Start's planning, we also want to avoid the mistakes. The harshest lesson we learned is that it is unwise to begin very quickly and on a national scale because quality control becomes difficult. The new program must be more carefully developed and tried out as a pilot project before large-scale implementation is considered. Keeping the program to a manageable size will make it easier to study what does and does not work and to correct implementation problems quickly. Then we can expand gradually, continuing evaluation and remaining

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watchful. The pace may seem unbearably slow to those eager to get on with the program, but it will give the final project a better chance for success. To facilitate the pilot phase, the PCCs and CCDPs can be used as demonstration sites: they have the facilities, personnel, and community contacts necessary to launch the project, and their location in all states will provide a nationally representative sample of participants and providers.

The new program must include health care and nutrition, parent involvement, family support, educational and social experiences, and developmental continuity.

The Children's Defense Fund suggests that 5% of Head Start expansion funds be used to increase services for very young children. In their proposal, which accelerates the rate of expansion, this would amount to $50 million the first year, increasing to $172.5 million in the fifth year. This amount, combined with the sums Head Start already spends on services for very young children, would fund a reasonably sized demonstration phase and provide for well-paced expansion.

Required program components

The exact details of the zero-to-three intervention will be the responsibility of the planning committee. We warn them to clearly specify their goals at the outset: a confusion over Head Start's mission has led many to misjudge the program's effectiveness. The new program must include all the components that experience has proven to be necessary for good developmental outcomes: health care and nutrition, parent involvement, family support, educational and social experiences, and developmental continuity. The content of these services must of course be adjusted to the special needs of infants and toddlers. Health care and good nutrition, for example, must begin prenatally and must focus on the mother throughout pregnancy and lactation. Parents are the child's first teachers, so other aspects of the intervention must center on them as well. As the planners think about how to structure the basic service components, they must also consider the relative emphasis each is accorded. Today the demographics of the impoverished population make certain services more crucial than they have ever been.

Rising rates of divorce and out-of-wedlock births have created soaring numbers of single-parent families. The vast majority of these are headed by women, whose earning potential is generally lower than that of men. Although births among teenage mothers have not escalated as rapidly, many more of them are likely to be outside of marriage: 90 percent of black teenage mothers are single, as are 40 percent of their white peers (National Commission on Children, 1991).

Young and/or single parents can be helped to be better caregivers if they receive emotional and practical support from their communities (see, for example, a review by Seitz, 1990). Although services may be available to help families meet needs such as housing, food, and child care, they may require assistance in accessing these programs. In the new intervention program this help might come from a family services coordinator, a position created in Head Start centers that serve children with disabilities and now mandated for programs serving infants and toddlers with disabilities under the Individuals with Disabilities Education Act. Parenting education is generally less available than other social services, so it must become a strong component of the intervention effort. With young parents in particular, knowledge about child rearing and the developmental process can relieve anxieties and lead to better parenting. Both home visitor and classroom approaches have proven to be effective ways to enhance parenting skills, and there are dozens of promising models that can be studied for adaptation to a national zero-to-three program.

Another demographic change that must be addressed in the early intervention program is the rise in the number of working mothers. Today over half of mothers with infants under 1 year old work outside the home. Mothers who receive welfare do not have to work or enter job training until their children are three, but the Family Support Act allows states to require mothers of younger children to attend school if they are teenagers or have not completed high school. Quality child care services must be available to these at-risk infants. The intervention program must make available a day care setting tailored to the needs of infants and toddlers. This could be a center or a network of family day care providers who receive training and practical assistance from program personnel. The Head Start Family Day Care Initiative is one effort of this type that may become a suitable prototype.

Quality services in the child care component must be assured by performance standards adapted to the special needs of infants and toddlers

Quality services in the child care component must be assured by performance standards similar to those mandated for preschool Head Start but adapted to the needs of younger children. That is, there must be trained personnel, good caregiver/child ratios, small group sizes, and programs that provide educational and social experiences to promote sound development. Because growth patterns are erratic during the early years of life, the program must be individualized to the unique needs of each child. These quality elements are absolutely necessary for at-risk children to have a chance at optimal development. Today too many young children are in child care settings that are horrific, devoid of so many environmental nutrients that their development may be compromised. For children whose futures are already threatened by poverty, such child care condemns them to a rut in the road leading to their own socioeconomic failure.

An early intervention program that includes a child care component has the potential for socioeconomic integration. An ideal setting for children is not one where

they experience segregation at an early age but rather where they are exposed to a rich mixture of cultural and socioeconomic groupings. Parents of all economic classes are finding good infant care unavailable and/or unaffordable. If the care in the new program was offered on a sliding-fee scale based on family income, it is highly likely that more affluent parents would enroll. This would create a degree of socioeconomic heterogeneity not currently found in publicly funded child care settings or in Head Start. Another benefit is that the existence of federal quality standards would set an example for the private sector to enhance the quality of care delivered to millions of non-poor children.

Conclusion

Recent legislation clearly shows that policymakers have accepted the need for and wisdom of providing comprehensive services for very young disadvantaged children and their families. Head Start has been authorized to expand its zero-to-three services, and the 1992 Head Start Improvement Act allows centers to provide health care to the younger siblings of enrolled preschoolers. Both the PCCs and CCDPs have also recently received expansion funds, and other types of parent-infant programs are being tried. These efforts are a step in the right direction, but they are relatively small, not always well defined, duplicative, and lack inter-program coordination.

To give some examples, the Administration on Children, Youth and Families has been remiss in regulating the activities of the PCCs. The centers of course must have flexibility if they are to fill local needs, but without some standards they do not form a coherent program that can be articulated or evaluated. The CCDPs are as yet too new to determine their operations or effectiveness, but it is clear that they serve the same population as the PCCs but for two additional years. Another example of overlap is Chapter 1's Even Start, which is supposed to offer a range of services to parents and children ages one to seven. The effort is becoming a literacy program for poor parents, a function recently mandated for Head Start's array of infant and preschool programs. Policymakers appear eager to do something for very young children, but they are in obvious need of a sense of direction.

We do not need a plethora of separate programs; rather, our children require a coherent effort that puts our best efforts together. To this end, we have suggested the formation of a planning committee to design a federal intervention program for very young at-risk children and their families. We already have the knowledge and many of the human resources needed to build such a program. By making better use of current federal expenditures in this area, we can also supply some of the financial resources that will be required. Instead of supporting so many overlapping programs, we should put their budgets together to create a unified effort that is built on state-of-the-art knowledge, is geographically more accessible, and is large enough to enable helpful evaluations.

Of course, to give access to all disadvantaged children in need of intervention services, further outlays from tax coffers will be needed. At a time of deficit crisis, these added expenditures may seem out of the question. Yet if we think of them as an investment in human capital, they are not difficult to justify. Preventive services are less costly than remedial ones. Children who begin life healthy and acquire the skills and motivation to learn have a good chance of learning. As they grow to become contributing members of the society, the small investment made in their early years will have compounded to reap a handsome dividend.

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The article "Of Elephants, Ethics, and Relationships: Tools for Transformation in the Training of Early Intervention Service Providers," which appeared in the August/September, 1993 issue of Zero To Three, contained several typographical errors. Readers may obtain a corrected version of the article by writing or faxing a request to the Editor, ZERO TO THREE, 2000 14th Street North, Suite 380, Arlington, VA 22201, Fax: (703) 528-6848.

ZERO TO THREE Notes

By Eleanor S. Szanton

Fifteen years ago, I became the half-time Executive Director of a very small, very new organization, The National Center for Clinical Infant Programs. Its budget was under $50,000. It did not even have a regular office. What it did have was an extraordinary group of individuals who invented it and formed its first Board of Directors. Coming from a wide variety of disciplines and backgrounds, together they practiced what they preached: that physical, cognitive, social and emotional development are totally interrelated and must be understood together. They studied together, even as they sought to affect change in training, best practice, and public understanding of the importance of the infant and toddler years. They shared perspectives among themselves and with others from the rapidly expanding field of infancy research—both clinical and developmental. And they were determined to make a difference for infants and toddlers and their families in this country.

Fifteen years later, I am retiring as Executive Director of **ZERO TO THREE**/National Center for Clinical Infant Programs. Its budget is close to $2 million. It has a program staff of eleven highly talented individuals, who together reflect the eclecticism that our board has modeled. **ZERO TO THREE** has touched the lives of huge numbers of infants and toddlers and their families, through those who provide, advocate for, and organize services for them. We hear people, including those who may never have heard of this organization or its bulletin, refer to a "zero to three" problem or a "zero to three" activity.

What has helped us to grow so fast in size and influence? In my personal view, the following factors, beyond the quality of our leadership, have been responsible:

1) **The impact of the research.** Research showing the importance of early development not only helped in the formation of NCCIP; through this organization and other sources, the findings began to reach educated parents and policy makers as well. Obviously, there is much left to learn about just what kinds of children are affected by what combinations of circumstances, and how permanently. However, we have learned a great deal. I need hardly say here that the evidence is now powerful that some factors profoundly affect some—perhaps many—young children, and that these effects set patterns not easily undone. The research has also provided increasing evidence that infants and toddlers are deeply affected by the kinds of relationships their caregivers have with their own community networks of support. Thus, increased concern for the earliest years was a stimulus to our own growth and the growth of programs which helped support new parents where needed.

2) **ZERO TO THREE/NCCIP's determination to be a catalyst and resource to others.** Obviously, in some areas we have taken a lead, encouraging others to work with us to accomplish an end. But, recognizing that wisdom comes in many places across this country, we have been good listeners, as well. We recognized early that there is no use in promoting one's own concepts in such a way as others cannot understand or use. On the other hand, there is much to be gained from enlarging the perspective of the questioners at just the moment they seek help, through one's own knowledge or by putting them in touch with others whose work they should know. Thus, in dozens of ways over these fifteen years, the staff of **ZERO TO THREE** has worked with parents, social workers, special educators, early childhood professionals, psychiatrists, pediatricians, nurses, physical and occupational therapists, psychologists, foundations and policy makers as they enrich each other's perspectives—and our own. In this way, we have learned and been strengthened as much from the front lines as from research.

3) **ZERO TO THREE's involvement in technical assistance to states and communities. ZERO TO THREE**'s leadership soon came to realize it could not simply say what kinds of conditions are important for infants and toddlers and helpful to their families at the program level alone. We realized we also had a responsibility to actively work with state and community administrators charged with *organizing* comprehensive, well integrated, family friendly services, to help them prevail against the real-world constraints of financing and public commitment. This is the origin of our technical assistance work with states and communities, as we attempt the extremely difficult task of making models work for many more children and families. We are especially grateful to the Maternal and Child Health Bureau of the Public Health Service, the U.S. Department of Education's Office of Special Education Programs, and the Head Start Bureau, as well as many national foundations in supporting our work in these and related areas.

So our message has been heard, and we have been helpful to many at the individual, program, community and state level. Always, however, we have come back to the need for more and better trained personnel in the programs that serve infants and toddlers and their families. In fact, training needs are becoming more serious: as funds are beginning to flow to programs for infants and toddlers, the personnel to create *and maintain* quality services is not in place. **THIS IS THE MAJOR CHALLENGE OF THE NEXT DECADE.** The board and staff of **ZERO TO THREE** welcome all those who will work with them toward addressing this problem.

As I step down, I want to welcome Associate Directors Carol Berman and Emily Fenichel, who together are taking immediate responsibility for directing our wonderful staff. These two highly gifted individuals have immeasurably increased the organization's impact. And though I am leaving **ZERO TO THREE**, I definitely intend to remain a contributor to our common goals.

Letter to the editor:

I would like to thank you and the contributors to the *Zero to Three*, August/September, 1993 issue for delivering a wonderful message of affirmation for interdisciplinary, relationship-focused intervention training programs.

The Graduate Certificate in Infant Mental Health is offered through the Merrill-Palmer Institute, Wayne State University, in cooperation with the faculties of education, nursing, psychology and social work. For professionals trained in these disciplines, with skills upon which our highly specialized society demands, specialization in intervention often means that the camera lens of the mind gets stuck on zoom, and can only focus on one part of the whole: the baby's muscle tone, the mother's depression, the empty refrigerator, the stack of beer cans, the missed appointment. Curiously, relationship-focused training invites an even closer look, but at a larger picture! By putting ourselves into a baby's place and by feeling the size and shape and weight of the important relationships in that baby's experience, we can learn to understand the full measure of our interventions as they affect the baby and all who are part of the baby's caregiving environment.

However, as every article in this important issue highlights, the first ghosts we encounter in an unfamiliar nursery are likely to be our own! Until we reach an understanding of ourselves and our earliest relationships, the babies we are trying to "help" will be as invisible to us as they are to their own parents. The skills needed to support infant-parent relationship development are dependent on the skills we develop for awareness, understanding and interpretation of our own responsive feelings.

The clinical practicum component of the Graduate Certificate in Mental Health program is a 12-18 month commitment. Since most of the trainees maintain full-time professional positions while completing certificate requirements, the practicum is structured to allow maximum flexibility while supporting a framework within which trainees can explore how relationships support growth and development — in infants, in parents, and in trainees. Relationships are explored as they are developed over time, through infant-family observational study, home-based intervention services, weekly individual supervision, and bi-weekly group seminars.

At the end of the practicum experience, trainees are most likely to credit the felt support of their supervisory and peer relationships for having the greatest impact on their growing abilities to "look" at relationships. On behalf of Deborah Weatherston, Program Director, and myself, thank you again for bringing us this closer look at the whole picture!

Kathleen Baltman, M.A., Clinical Coordinator, Graduate Certificate Program in Infant Mental Health, The Merrill-Palmer Institute, Wayne State University, 71-A East Ferry Avenue, Detroit, Michigan 48202, (313) 872-2408

Videotapes:

Mastering the Tasks of Toddlerhood, from the series **Bettye M. Caldwell on Infancy and Toddlerhood**. Produced and distributed by Davidson Films, Inc., 231 "E" Street, Davis, CA 95616, tel: (916) 763-9604. 25 min. $190. Rental $50.

Bettye M. Caldwell, who wrote and narrates this video, defines toddlerhood as beginning when the child begins to walk, at about one year, and lasting until about three years of age. Toddlers begin this stage with an egocentric view of the world. Through social experiences and exploration, toddlers come to know that others have different points of view and they can take those views into account — at least some of the time.

In this tape, toddlers demonstrate three interconnected developmental steps: autonomy, mastery, and language development. Caldwell offers practical suggestions to caregivers to support the development of toddlers at each step. The issue of autonomy is presented in terms of the emotional consequences of the child's becoming upright and becoming able, literally, to separate himself or herself from others. The challenge for caregivers is to allow children at this stage to do what they can do and intervene when they try to do something they cannot or must not do. Mastery is illustrated through toddlers' trial-and-error experiments in the environment, as they explore spacial relationships and imitate adults and each other. Language acquisition changes the world for a child; skilled caregivers use every opportunity to talk to toddlers in meaningful ways, providing language experience by listening and responding so as to expand and extend the child's language. As the tasks of toddlerhood are mastered, children come to know that they are separate beings, able to solve problems and communicate with others.

Other videotapes in this series include **In the Beginning: The Process of Infant Development** and **Nurturing**.

Cognitive Development, from the series **Human Development: The First 2 1/2 Years**. Produced and distributed by Concept Media, Inc., P.O. Box 19542, Irvine, CA 92713-9542, tel: (800) 233-7078. 25 min. $280.

Cognitive Development, defines cognition or intellectual activity as the process by which humans acquire and use knowledge. Between birth and two-and-one-half years, the child learns how to learn. In this video, infants and toddlers demonstrate sensory development, perception, memory, and problem solving skills, as important aspects of cognitive development. The tape discusses how young children learn to learn as they progress from random exploration, gross exploration, minute examination, practice, experimentation, and, finally, to putting information to use. Piaget's conceptualizations of object permanence and stages of sensorimotor development are illustrated in the tape.

The final segment of the tape focuses on facilitating the cognitive development of young children and describes the environment that is most conducive to optimal development. Caregivers are encouraged to become partners with the infant in a give-and-take relationship, to offer abundant opportunities for reciprocal play, to provide a variety of play materials and experiences, and to establish regularity in daily caregiving routines.

This series of tapes also includes **Physical Growth and Motor Development**, **Language Development**, and **Emotional/Social Development**.

Publications:

The Emotional Life of the Toddler (1993) - Alicia F. Lieberman (The Free Press, 866 Third Avenue, New York, NY 10022) $22.95.

The most important emotional accomplishment of the toddler years, suggests Dr. Lieberman, is reconciling the urge to become competent and self-reliant with the longing for parental love and protection. This volume explores the ways in which young children, assisted by parents and caregivers, struggle with this dilemma. The ideas presented represent Lieberman's personal synthesis of child observation, clinical work with toddlers and their families, theories of development, and current research findings. The organizing themes come from the basic premise of attachment theory, which suggests that toddlers can grow into autonomous and competent children only if they can rely on an adult who makes them feel safe and protected. From this basic feeling of security grows the impetus to try out new skills and learn how things work in the world.

Lieberman explores the notion of a partnership between parent and toddler, particularly as pressures for socialization begin toward the end of the second year of life. Lieberman explains:

...(Parents of older toddlers must) help the child become a partner in sorting out disagreements and finding solutions that will preserve mutual good will. This partnership leads to a more complex feeling of security that is based on the child's growing feeling of competence in conflict resolution.

Partnership is a reliable ally for the child in times of grief, anger, and frustration because it serves as a protection from despair and emotional collapse... Through the emotional partnership between parent and child, the supportive function of the parent becomes a part of the child... The child comes to carry the parents' care and protectiveness inside of him wherever he goes.

In addition to providing an overview of the emotional importance of early relationships, Lieberman addresses specific issues, including the socialization of temperament, play and the mastery of anxiety, divorce as "secure base disruption," and the toddler in child care.

Social Referencing and the Social Construction of Reality in Infancy (1992) - edited by Saul Feinman (Plenum Press, 233 Spring Street, New York, NY 10013) $65.00.

"Referencing," notes Saul Feinman, "...(stretching) beyond infancy to meander on through the lifespan,...(is) one of the critical ways in which the individual's construction of reality is socially influenced." Social referencing (defined as "a process in which one person utilizes another person's interpretation of the situation to formulate her own interpretation of it") is of relevance to developmental and social psychology, and to sociology's and anthropology's basic interest in how individuals become enculturated into their societies. As such, argues Feinman, it is essential that the study of social referencing in infancy be informed and guided by what is known about related processes.

This volume is the outgrowth of a study group funded by the Society for Research in Child Development to integrate social referencing within the broader study of human relations. Members of the group, and contributors to this volume, include Mary D. Salter Ainsworth, Albert Bandura, Inge Bretherton, Norman Denzin, Robert Emde, Saul Feinman, Jacob Gewirtz, Michael Lewis, Robin Hornik Parritz, Barbara Rogoff, Murray Webster, and Ina Uzgiris, among others.

The volume offers a review of the referencing literature and a series of chapters that look at aspects of referencing from different theoretical perspectives. The major themes examined include:

- Cognitive and social skills that form the foundation of referencing and that can also be found in related processes, such as intentional communication;
- The ways in which the process of social referencing articulates with other phenomena, such as imitation, classical conditioning, and receptivity to input from particular people;
- Relationships within which referencing takes place; and
- Ways in which social referencing functions within the broader settings of family and society.

In his chapter, "Social Referencing Research: Uncertainty, Self, and the Search for Meaning," Robert N. Emde notes that "social referencing sharpens our focus on what is meaningful — on what is emotionally important and can be shared; it also directs us to what is individual and unique." Emde suggests that individual differences in infant social referencing (seen as a "barometer" of adaptive functions) might be important for later psychopathology because, since social referencing is a mediator of relationship information, individual differences in social referencing should "reflect individual differences in more fundamental aspects of the quality of the parent-infant relationship and its underpinnings in the emotional availability of the parent." He suggests that clinicians use awareness of disturbances of social referencing as an indication to look further in two directions. First, unusual patterns of social

Continuned on page 33

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referencing might alert the clinician to infancy syndromes of abuse/neglect, failure to thrive, and other regulatory disorders involving sleep, feeding, security, separation, and oppositional interactions. Second, unusual patterns of social referencing might alert the clinician to risk situations for later-developing psychopathology, including depression or anxiety in a parent, negative or hostile parental attitudes, pronounced conflict and hostility between parents, and disorganization in the larger environment, including situations of poverty and social isolation.

Early Deprivation of Empathic Care (1993) - John Leopold Weil (International Universities Press, Inc., 59 Boston Post Road, Madison, CT 06443) $30.00.

Dr. Weil defines the "central core" of a caregiver's empathic reaction for an infant as "the capacity of the caregiver to experience pleasure in response to the infant's pleasure and to experience tender unpleasure (sadness, concern) in response to the infant's unpleasure." He sees the central core of an infant's emerging reactivity as "the capacity of the infant to experience pleasure in response to the caregiver's pleasure and to experience unpleasure in response to the caregiver's unpleasure." Because no simple, fixed prescription can tell an adult how to fulfill an infant's changing needs from moment to moment or how to relieve an infant's ever-changing conditions of distress, Weil argues that an infant requires the benefits of **empathic** care — persisting, positive, tactile, visual, and auditory attachment; attention; tenderness; and empathic, resonant, emotional awareness.

Weil considers early deprivation of empathic care as an antecedent for pathology occurring during infancy, childhood, and adolescence which may be associated with: 1) "hyper" and "hypo" states of arousal; 2) chronic losses of pleasure; and 3) "compensatory supply lines" of pleasure. Discussing the third phenomenon, the author notes that while healthy infants can be observed changing from one supply line of pleasure to another in accordance with their needs and the sources of pleasure available, pathology appears to derive from the degree to which the infant turns away from the caregiver as it turns predominantly to the inanimate world, its own body, or the state of sleep. "It is the unending deprivation leading to the infant's unending turning to its self and away from others ...which provides a source for pathology," he observes.

Stress and Coping in Infancy and Childhood (1992) - edited by Tiffany M. Field, Philip M. McCabe, and Neil Schneiderman (Lawrence Erlbaum Associates, Inc., Suite 102, 365 Broadway, Hillsdale, NJ 07642) $49.95.

This fourth volume based on the University of Miami's annual symposia on stress and coping focuses on developmental stressors and clinical stressors during infancy and childhood. Developmental stressors are defined as those that arise during normal development; these include early separation stress, stranger anxiety, novelty stress, and feeling scared. Clinical stressors include experiences of premature birth, invasive medical procedures, respiratory disease, and cancer.

The editors suggest that since stress and coping begin at the moment of conception and continue across the lifespan, it is not surprising that young children are able to cope with significant stressors and that individual differences in responses to stress and individual styles of coping emerge early in infancy. Examining infants' ability to cope physiologically with the stress of separation and novelty, Megan Gunner notes babies' ability to adapt to repeated separations, as manifested by their attenuated responses to stress. Jacob Gewirtz and Martha Paelaez Nogueras suggest that late in the first year of life infants learn from their mothers' cues to protest separations; they suggest that mothers who are more contingently responsive to their babies' smiles or vocalizations than to their protests, or who talk to their infants at play, tend to produce babies who protest neither their mothers "departure cues" nor "separation cues." In other chapters, Brian Healy examines the relation between physiological response patterns and the development of individual differences in temperament as they relate to stress, and Nathan Fox reviews individual differences in temperament, responses to stress, and underlying EEG patterns.

Cognitive Coping, Families, and Disabilities (1993) - edited by Ann Turnbull, Joan M. Patterson, Shirley K. Behr, Douglas L. Murphy, Janet G. Marquis, and Martha J. Blue-Banning (Paul H. Brookes Publishing Company, P.O. Box 10624, Baltimore, MD 21285-0624) $28.00.

Cognitive coping, the editors of this volume suggest, involves thinking about a particular situation in ways that enhance: 1) self-esteem, 2) a feeling of control, and 3) a sense of meaning. The particular situation addressed in this book is giving birth to and/or raising a child with a developmental disability over the entire life span. Cognitive coping theory suggests that recognizing the positive benefits of such an experience is not evidence of "denial" or "rationalization" but rather a positive adaptation to stress.

This book is the outcome of a "participatory research" process, which assumes that "research is the enterprise of not only scientists, but also consumers of research, including families and service providers." The process seeks to combine scientific knowledge and experiential knowledge. In this instance, the Beach Center on Families and Disability at the University of Kansas and the Center for children with Chronic Illness and Disability at the University of Minnesota co-sponsored a conference at which families, service providers, researchers, and theorists shared their perspectives on a common set of themes, trends, and patterns of implications related to cognitive coping.

Participants in the conference, who became contributors to this volume, were selected for their perspectives in generating theory, conducting research, providing services, or having experience as a parent or a person with a

developmental disability. Contributors include Aaron Atnonovsky, Glenn Affleck, Shirley K. Behr, Martha J. Blue-Banning, Pauline Boss, Jonathon D. Brown, Beverly A. Bush, Corinne W. Garland, Laraine Masters Glidden, Tamar Heller, Michael K. Kiphart, Marty Wyngaarden Krauss, Evelyn Lusthaus, Charles Lusthaus, Janet G. Marquis, Hamilton I. McCubbin, Donald J. Meyer, Douglas L. Murphy, Judy M. O'Halloran, Joan M. Patterson, Florene Stewart Poyadue, Jane B. Schultz, Marsha Mailick Seltzer, George H.S. Singer, C.R. Snyder, Howard Tennen, Anne I. Thompson, Elizabeth A. Thompson, Suzanne C. Thompson, Ann P. Turnbull, H.R. Turnbull, III, Janet Vohs, and Jennifer C. Willoughby.

Life After Birth: Every Woman's Guide to the First Year of Motherhood (1992) - Wendy Blumfield (Element, 42 Broadway, Rockport, MA 01966) $12.95.

Written by the founder of the Israel Childbirth Education Center, this book is designed "for all who are concerned with the physical and emotional health of the woman after birth" — partners, parents, in-laws, health care providers, and new mothers themselves. Chapters address the fantasy and realities of pregnancy and birth; "three-day blues" and postnatal depression; learning and adapting to the new routines required by infant care; changes in identity for mother and father; sources of support; and mourning fetal or neonatal death. Ms. Blumfield draws on both published research and personal experiences from her work in childbirth education.

In a chapter on postnatal depression and sources of treatment and support, Ms. Blumfield describes the "fourth trimester follow-up" approach used at a California hospital to confirm and supplement nurses' impressions of mothers at the time of childbirth. Nurse Nancy Donaldson notes:

We telephone each mother during her first week at home... If there is no problem, we do not continue the contact but assure the mother that she can call us 24 hours a day. If we feel that there is a potential for disturbance, we call again and we can communicate the results of the follow-up assessments to the appropriate community resources or agency. Fifty-six percent of families need more than one telephone call!

Calls for proposals

The National Mental Health Association/American Counseling Association Partnership in Prevention, in conjunction with a number of other professional organizations and agencies, will host a prevention training institute, entitled, "Sharing What Works!", on October 20-23, 1994 in Washington, D.C. Proposals are invited for day-long training workshops, symposia, roundtables, debates, town hall meetings, or poster presentations. Priority will be given to collaborative presentations by researchers and practitioners. The *Journal of Primary Prevention* will publish selected presentations from the Institute. **The deadline for submissions is December 1, 1993.** For information, contact: Sandra McElhaney, National Mental Health Association, 1021 Prince Street, Alexandria, VA 22314, tel: (703) 838-7506.

The Ministry of Science and Technology of the State of Israel will hold an international conference in Jerusalem, Israel, May 29-June 1, 1994 on "The Family on the Threhold of the 21st Century: Trends and Implications." Main topics include immigration and the family, gender issues in the family, stress, life styles and patterns in the contemporary family, changes in the family life cycle, and legal, economic and historical trend affecting the family. **Abstracts must be received by December 31, 1993.** For information, contact Conference Secretariat, ISAS International Seminars, P.O. Box 574, Jerusalem 91004, Israel, tel: 972-2-868-124, FAX: 972-2-868-165.

Conference call

December, 1993

December 11-14: *NAPARE, the National Association for Perinatal Addiction Research and Education,* will hold a multidisciplinary national conference in Chicago, Illinois, entitled "Building on Strengths." For information, contact NAPARE, 200 N. Michigan Avenue, Suite 300, Chicago, IL 60601, tel: (312) 541-1271, FAX: (312) 541-1271.

February, 1994

February 4: The *University of North Texas Center for Parent Education* will sponsor a conference on parent education, with Ellen Galinsky as keynote speaker. Contact Arminta Jacobson, Director, Center for Parent Education, P.O. 13857, University of North Texas, Denton, TX 76203-6857.

June, 1994

June 8-11: The *World Association of Infant Mental Health* (WAIMH) will sponsor a conference on the mental health of infants, children, and parents, in Riga, Latvia, on the topic "Adaptive Changes to Infant and Child Care in a Rapidly Changing Social-Political-Economic System — Which Models Apply Best?" For information, contact Kaspars Tuters, 315 Avenue Road, Suite 9, Toronto, ON, M4V 2H2, Canada, tel: (416) 964-6777, FAX: (416) 928-0870.

June 9-12: The *Family Research Consortium II,* supported by the National Institute of Mental Health, will sponsor a summer institute for family researchers in Santa Fe, New Mexico. The theme will be "Family Conflict and Cohesion," with special emphasis on the study of family diversity. The Institute accepts a small number of both junior and senior researchers as participants. Contact Donna Fleming, Frank Porter Graham Child Development Center, UNC-Chapel Hill, Chapel Hill, NC 27599-8180, tel: (919) 966-2622, FAX: (919) 966-7532.

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